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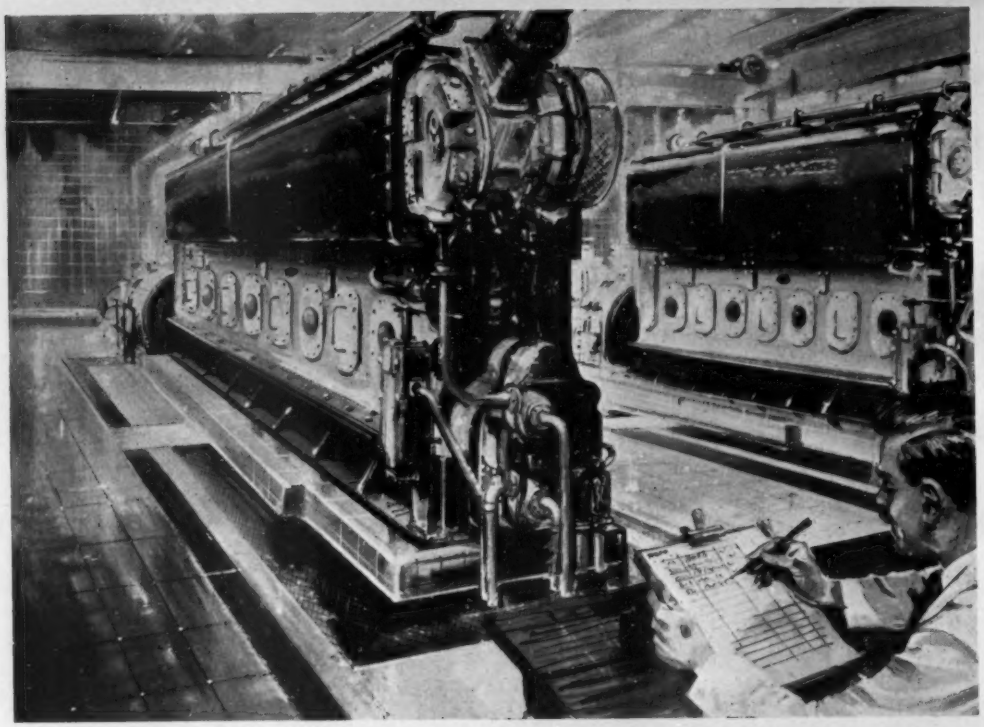

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IRON AND COAL
TRADES REVIEW

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Look Ahead With Coal

PRESUMABLY designedly and probably advisedly, Sir James Bowman made no reference in his address at Llandudno last week to the conjectures regarding future organization which were the subject of so many fiery speeches during the course of the mineworkers' conference. In an address which has been variously described as an apology and an apologia, he confined his remarks concerning the future to an appraisal of the market situation and an expression of view on the steps which the industry as at present organized will need to take to meet the increasing competition that coal is encountering as a fuel and as a source of energy.

While Sir James's critics may perhaps fairly argue that he was on firmer ground in his appraisal of the future than in his explanation of the past, there was nothing in his address that could be regarded as apologetic in tone. He is obviously gratified at the National Coal Board's achievements over the past five years, and was quick to affirm that he was "one of those who thinks that nationalization of the coal industry has been an outstanding success, and has served this country well."

To some the words "nationalized" and "nationalization" are anathema; nothing Sir James said last week—or is likely to say in the future—will alter their conviction that nationalization of coal has been a failure, that under private enterprise there would have been plenty of coal for everybody, both at home and abroad, in every year since the war—coal, moreover, of good quality and low price—and that the industry would have been spared the troubles which afflict it today. They blame nationalization for the shortages of the past as well as the surpluses of the present. Let those of extreme view on this controversial subject—"pro" like Sir James and his Llandudno audience or "anti" like the most vociferous of the industry's critics in Parliament and Press—have their say and state their opinions. Nothing said on either side can affect the past: what matters now is the future. Coal will not be denationalized in any period of years reasonably foreseeable at present. That at least seems certain in this uncertain world. Whatever plans the present Government has in mind for coal, they do not include putting the industry back into the hands of private enterprise. That much the Minister of Power has stated categorically. If Labour returns to power at the next General Election it is not likely to denationalize coal. A Liberal Government might presumably have a shot at it, but that is scarcely a likely eventuality. Denationalization is out. Many will say "more's the pity," but there it is.

Whether the policies followed by the National Coal Board since the 1947 vesting date call for an apology or an apologia does not matter a great deal. Nationalization of coal is with us to stay, and the paramount importance of the industry to the nation dictates that we make the most of it. Critics of nationalization have a right to their opinion, but to condemn the coal industry on all points and on every occasion merely because it is nationalized is to be as blind ideologically as the most fervent advocate of State control of everything. To claim that a nationalized industry is necessarily right in everything it does is equally foolish and just as irrational. Efficiency is the only true yardstick to use in measuring the worth of an industry's efforts—efficiency, that is, in relation to service to the community. Is an industry producing the product the nation needs in the quantities and qualities required and at the lowest possible price commensurate with the provision of fair wages and good working conditions and a reasonable return on the capital invested in it? If it is doing that it deserves well of the nation.

This is the yardstick to apply to the coal industry today by anyone who wishes to set up as its critic. It is one which the Government is right to apply, for the Government is the elected custodian of the nation's welfare. Most important of all, it is one for the industry to apply to itself, in its own interest and in the interest of the community. Let us not concern ourselves any longer with whether or not it was right 13 years ago to nationalize the coal industry. Let it not be judged from opposing political viewpoints, maintaining on the one hand that it can do no wrong because it is nationalized, or that because of nationalization *ipso facto* it can never do right.

Above all, let us not prejudge suggestions put forward in good faith for the betterment of the nationalized industry, whether they come from within or without. We do not profess to know what plans, if any, the Government has for the future of the industry. The National Union of Mineworkers affirms that there are plans, and it is even suggested that the miners' leaders know what those plans are. Is not the sensible thing to do to await the details before condemning them

out of hand? To suggest that nowhere in the industry is there room for improvement is surely burying one's head in the sand. Nationalized coal is with us to stay, but there is nothing sacrosanct about the industry's methods of working. If it is thought that they can be improved, the industry and all those engaged in it should be prepared to listen to the suggestions with an open mind, unclouded with preconceived ideological or political convictions.

Order for £60,000,000 Nuclear Power Plant

CONTRACT for the construction of the 500 mW nuclear power station at Dungeness (Kent) is to be awarded to the Nuclear Power Group, comprising Associated Electrical Industries, Limited, John Thompson Nuclear Energy Company, Limited, and the Nuclear Power Plant Company, Limited. Value of the contract, placed by the Central Electricity Generating Board, is understood to be between £55,000,000 and £60,000,000.

Work is expected to start on the site immediately and it is hoped to complete it by the end of 1964. It is the eighth station in the British nuclear power programme.

With the Dungeness order and the stations now being built at Berkeley (Glos), Bradwell (Essex), and Latina, near Rome, the Nuclear Power Group has orders for commercial nuclear power plant worth £157,000,000 on its books. Members of the Nuclear Power Plant Company include C. A. Parsons & Company, Limited, A. Reyrolle & Company, Limited, Parolle Electrical Plant Company, Limited, Head, Wrightson & Company, Limited, Sir Robert McAlpine & Sons, Limited, Alex Finlay, Limited, Clarke Chapman & Company, Limited, Whessoe, Limited, and Strachan & Henshaw, Limited.

The AEI-John Thompson group includes Associated Electrical Industries, Limited, John Thompson Nuclear Energy Company, Limited, John Laing & Son, Limited, Balfour, Beatty & Company, Limited, and Nuclear Graphite, Limited, a jointly owned AEI-Morgan Crucible subsidiary.

METAL INDUSTRIES' DIVIDEND RISE OF 1 PER CENT.

FINAL dividend of 9 per cent. is announced by Metal Industries, Limited, making a total as forecast of 15 per cent. on its "old" ordinary stock for the year to March 31, 1960, against 14 per cent. previously. Consolidated profits for companies in the group other than those formerly comprising the Lancashire Dynamo group, which Metal Industries acquired earlier this year, rose from £1,503,963 to £1,722,715. Tax takes £835,154 (£693,097), leaving the net profit up from £810,866 to £887,561.

Group profits of Lancashire Dynamo Holdings, Limited, are reported at £863,273 for 1959, against £836,466 previously. After tax of £496,518 (£439,670), the balance is £366,755, compared with £396,796.

ALD. F. A. GENT, chairman of Derbyshire Education Committee, who began his working life as a boy in the Nottinghamshire coalfield, has been awarded the honorary degree of M.A. by Sheffield University.

Passing Thoughts . . .

IF Sir James Bowman could be lured into politics he would be certain of a high position in the Labour Party—if that means much these days. It is not so many years since Sir James was being spoken of as the inevitable successor to Ernest Bevin. It would be poetic justice if the Labour Party, having lost Mr. Robens to the Coal Board, should get Sir James from it.—"Observer," in the Financial Times.

> *If he [Sir James Bowman] cared to turn to the political side of the Labour movement he would be an immense asset to it. If he is reluctant to be active in party politics in the narrower sense, a life peerage would enable him to contribute much to political life. His abilities should not be lost to the nation.—The Guardian.*

The boom in the [domestic] appliance trade has brought many new firms into the field and when they all get into their stride there will be considerable overproduction which may lead to difficult trading conditions.—MR. P. D. M. AIRD, chairman of Glover & Main, Limited.

> *The July Which reports on "inflammable rubbish" for picnic stoves. Eight national daily newspapers each boiled three pints in six minutes or under. The Times took 8½ minutes and made "fairly dense smoke"; The Financial Times 9½ minutes and "very dense smoke."—Observer, in the Financial Times.*

I cannot understand why the miners' conference declared so emphatically against the decentralization of their industry. The NUM itself is an outstanding example of decentralization. The headquarters of the NUM has absolutely no control whatever over the workings of the Area organizations.—Letter to the Sheffield Telegraph.

> *The coal industry as constituted lacks enterprise, force, and initiative, and is held down by the old-fashioned notions of its component parts. If the wind of change were applied to it with sufficient pressure by the authorities, it might fall for the pulverized fuel idea.—Letter to the Yorkshire Post.*

It is a pity that some of our competitors seem to think that the only way of reducing costs is to increase their own output by quoting lower and lower prices. I can only hope they will come to realize that this always provokes retaliation, and that these battles are usually won by the firm with the longest purse rather than the one with the most aggressive sales manager.—MR. MICHAEL HOPE, chairman of Henry Hope & Sons, Limited, metal window manufacturers, of Smethwick.

> *Some of us feel that public demand for the 12-hour extension has lessened considerably. It's like living on the edge of a volcano for 12 hours. Publicans are glad when its all over.*—MR. JACK RANSON, *secretary of the Durham branch of the Licensed Victuallers Association, referring to the Durham Miners' Gala.*

It is, however, to be feared that . . . the smokeless zone—and the smoke—will long remain "in the air." The truth is that most people prefer the traditional coal fire and will be fecund of arguments for retaining it.—Newcastle-upon-Tyne Journal.

JOHNSON, MATTHEY & COMPANY, LIMITED—Mr. G. C. H. Matthey has relinquished his chairmanship but remains on the board.

Steel Output

JUNE RESULTS MAINTAIN STEADY ADVANCE

ADJUSTMENTS made to correct the rates of steel production for interruptions caused by the Easter and Whitsun holidays and other seasonal influences show that production maintained a moderate rate of advance during the first half of 1960 after the substantial upswing during 1959. Production in June, which was affected by the Whitsun holiday, was at an average of 466,400 tons a week, compared with 475,400 tons a week in May, and with 388,500 tons a week in June, 1959.

The Iron and Steel Board states that the June figure indicates that steel production made a recovery from the temporary setback in May which had resulted partly from the bunching of repairs at steelmaking furnaces and partly from the interruption of the flow of pig-iron during the relining of blast furnaces at integrated plants.

Production of pig-iron in June averaged 295,200 tons a week compared with 299,100 tons a week in May and with 235,300 tons a week in June, 1959.

Estimates and Actuality

Production of steel in the first half of the year amounted to 12,390,000 tons and is in line with the total which had earlier been expected for the year as a whole. This was put at 24,300,000 tons in the estimates prepared at the end of the first quarter.

So far this year the recorded tonnages (with seasonally corrected figures in parentheses) are as follow:—January, 471,000 (452,000) tons; February, 482,000 (458,000) tons; March, 485,000 (453,000) tons; April, 478,000 (460,000) tons; May, 475,000 (438,000) tons; June, 466,000 (465,000) tons.

The seasonal corrections are based on an analysis of the seasonal variations in output during the past 10 years and should be treated as provisional. A technical note on the method adopted is in preparation and is to be issued by the Iron and Steel Board shortly.

Latest pig-iron and steel output figures (in tons), with the corresponding 1959 returns, are shown in the following table:—

Period.	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1960—April ..	310,600	16,150,000	478,100	24,861,000
May ..	299,100	15,554,000	475,400	24,723,000
June ..	295,200	15,353,000	466,400	24,255,000
Half year ..	302,800	15,745,000	476,400	24,772,000
1959—April ..	231,300	12,027,000	387,300	20,139,000
May ..	240,500	12,504,000	384,600	19,999,000
June ..	235,300	12,235,000	388,500	20,200,000
Half year ..	229,700	11,943,000	371,600	19,321,000

ATTENDANCE at the International Machine Tool Exhibition, which closed at Olympia last Friday, totalled 105,030, compared with 102,316 at the previous show in 1956 which ran for a day longer. About 10,000 oversea visitors attended and reports indicate that the number of orders placed was substantial.

London Quotation Sought by German Steelmakers

APPLICATION for a London quotation for the capital of August Thyssen-Hütte, AG, is considered to be a major event for the market and this is the first occasion since the war that a European company has sought an official quotation on London. ATH is the largest single steel manufacturing group in Europe and its capacity of about 4,000,000 tons of steel—to be raised by 25 per cent. over the next two or three years—exceeds that of the United Steel Companies, Limited, by about a third.

The original steelworks was founded in 1890 by August Thyssen and was inherited by his son, the late Fritz Thyssen, in 1926. Fritz Thyssen built it up into Vereinigte Stahlwerke, and after first supporting Hitler broke with him and emigrated to the Argentine. He died there in 1951. His widow and daughter hold about half the equity of ATH and Frau Thyssen about half the shares of Phoenix Rheinrohr, Germany's biggest makers of tubes. Both companies work in close conjunction, but a recent attempt to link them even more closely was resisted by the High Authority of the European Coal and Steel Community.

In 1958-59 ATH accounted for more than half Germany's output of hot rolled wide steel strip and over a quarter of its wire rod production. Even when the industry was recovering after the recent recession, ATH sales rose to £156,000,000 and its trading profits to £25,000,000, while its dividend was about twice covered.

The company has the advantages of having almost entirely post-war equipment and has spent some £104,000,000 on plant since 1949.

"Out of the Crucible"

LISTENERS to the BBC Welsh Home Service on Tuesday (7 p.m.) will be able to hear the story of Sidney Gilchrist Thomas (1850-1885) in a programme entitled "Out of the Crucible."

A memorial to Thomas was unveiled last week by Mr. G. H. Latham, chairman of the Whitehead Iron & Steel Company, Limited, and president of the Newport and District Metallurgical Society. A report of that ceremony is on page 143 of this issue.

SCHEME OF ARRANGEMENT giving effect to the merger of Henry Simon (Holdings), Limited, of Stockport (Ches), and Simon-Carves, Limited, Stockport, has now been sanctioned.

Personal

A Guest at the Palace

AMONG the guests at a private luncheon party given by the Queen and the Duke of Edinburgh at Buckingham Palace on Thursday of last week was SIR ELLIS HUNTER, chairman and managing director of Dorman, Long & Company, Limited, iron and steel makers of Middlesbrough.

SIR ELLIS HUNTER

Sir Ellis joined the board of Dorman Long as deputy chairman in 1938 and was appointed its chairman 10 years later. In 1945 he became the first chairman of the British Steel Producers' Conference and in the same year was elected president of the British Iron and Steel Federation, a position he held until 1953. He took a leading part in formulating the Iron and Steel Industry's Plan of Development, which was submitted in 1945 and later approved by the Government and published as a White Paper.

At the moment Sir Ellis is sitting for a portrait commissioned by the British Iron and Steel Federation from Maj. Aubrey Davidson-Houston. Dorman Long has also commissioned a portrait of its chairman and a third study is being painted for Sir Ellis's home. He is also chairman of British Structural Steel, Limited, Lingdale Ironstone Mines, Limited, Redpath, Brown & Company, Limited, and the Tees Side Bridge & Engineering Works, Limited, and of a number of other companies within the Dorman Long group.

After 46 years in the mining industry Mr. WILLIAM HUNTER, overman at Mauchline Colliery (Ayrshire) for 20 years, has retired.

Queen's Commendation for Brave Conduct has been awarded to Mr. THOMAS JOYCE, a cutter machine man at St. John's Colliery (Northants), for courageous action when an explosion occurred in the pit.

The Queen presented the George Medal to Mr. JAMES GILLAN, manager of Hartley Bank Colliery, Wakefield, at Buckingham Palace on Tuesday. Mr. Gillan dragged his undermanager to safety when he was overcome by firedamp at the colliery.

Capt. S. HARRISON-SMITH, head of the nuclear power section of Swan, Hunter, & Wigham Richardson, Limited, has been appointed head of the engineering department at Neptune Works, Newcastle-upon-Tyne. He will continue as head of the nuclear power section.

Scientific Instrument Manufacturers' Association of Great Britain has elected Mr. G. C. OTTWAY as president. He succeeds Mr. L. A. WOODHEAD, who becomes vice-president. Mr. A. W. JONES has been elected a vice-president, Mr. A. W. A. RUNDLE honorary treasurer, and Mr. E. R. PONSFORD secretary.

Midland regional council of the Federation of British Industries has elected Mr. S. DAWSON COLLINS, chairman and managing director of C. H. Collins & Son, Limited, Birmingham, and of the subsidiary, Midland Utilities, Limited, as chairman. He succeeds Mr. J. EDWARD BELLISS, managing director of Belliss & Morcom, Limited, Birmingham. Sir EDWARD THOMPSON, chairman of John Thompson, Limited, Wolverhampton, has been re-elected deputy chairman.

After 41 years with British Ropes, Limited, Mr. T. W. F. BOLLAND has retired. He began his career in 1919 with the Doncaster Wire Company, Limited, which was later acquired by British Ropes. He worked at the Retford and Birmingham works and for the past 13 years has been general manager of the wire mills at Doncaster.

Mr. A. K. KIRK has been appointed a Sheriff of the City of London. He is the founder and chairman and managing director of Kirk & Company (Tubes), Limited, London, S.E.16, and chairman and managing director of Samuel Russell & Company, Limited, malleable and grey-iron founders, of Walsall, and of the Cambrian Forge & Foundry, Limited.

For what will be his fourth term of office Mr. R. A. BARTRAM, chairman and managing director of Bartram & Sons, Limited, Sunderland, has been elected president of the Wear Shipbuilders' Association. He succeeds Mr. A. J. Marr, managing director of Sir James Laing & Sons, Limited. Mr. J. V. THOMPSON, managing director of Joseph L. Thompson & Sons, Limited, has been appointed vice-chairman.

Mr. B. KENDALL, deputy production manager (operations) of the No. 1 Area of the East Midlands Divisional Coal Board, has been made an Officer Brother of the Order of St. John. He has been an active worker in the St. John Ambulance Brigade since 1934 when he joined the brigade at Markham and Ireland collieries. Since 1957 he has been commissioner of the No. 1 Area of the brigade.

Mr. ALBERT G. WEBSTER, secretary of the No. 8 (Castleford) Area, North-Eastern Divisional Coal Board, has retired. In 1911 he joined Briggs Collieries, Limited, at Whitwood and remained with the company until vesting day when he became personal clerk to the deputy Area general manager, No. 8 (Castleford) Area. He was appointed administrative officer for the Area in 1947 and secretary in 1956.

Aberdeen University has conferred the honorary degree of Doctor of Laws on Sir WILLIS JACKSON, FRS, president of the Institution of Electrical Engineers, and director of research and education of Associated Electrical Industries, Limited. Honorary degree of D.Sc. has been conferred by Queen's University of Belfast on Sir WALTER DRUMMOND, deputy chairman of the National Coal Board, 1951 to 1955.

North-Eastern Area Transport Users' Consultative Committee has elected the following members:—Mr. J. GERRARD, managing director of Wright, Anderson & Company, Limited, structural engineers and bridge builders, of Gateshead; Mr. G. C. SEWELL, transport manager of the South Durham Steel & Iron Company, Limited; and Mr. I. S. MCKAY, distribution manager of the Billingham division of Imperial Chemical Industries, Limited.

Stewarts and Lloyds' Furnace Relit

LARGEST of the four furnaces at the Corby (Northants) steelworks of Stewarts and Lloyds, Limited, the No. 1 blast furnace has been relit and will now burn continuously for four years.

The relighting follows the relining and general maintenance of the furnace, which was completed in 35 days. One of the company's four blast furnaces is closed down each year for maintenance. Mr. George Smith, 65-year-old steelworker who has spent 47 years at Corby, relit the furnace and received a presentation from the company.

FUEL AND POWER

Council for Research and Development

DECISION to wind-up the Fuel Efficiency Advisory Committee and to reconstitute the Scientific Advisory Council has been announced by Mr. Richard Wood, Minister of Power. The Scientific Advisory Council will be known as the Advisory Council on Research and Development and it will take over the functions of the Fuel Efficiency Advisory Committee. The council's terms of refernce have been amended so as to emphasize that its advisory functions cover all aspects of research and development concerned with fuel and power from the laboratory to industrial application.

The council will advise the Minister on research and development in relation to his statutory duty of securing the effective and co-ordinated development of coal, petroleum, and other sources of fuel and power in Britain, and of promoting economy and efficiency in the supply, distribution, use, and consumption of fuel and power, whether produced in Britain or not.

It will also advise the Minister of new scientific and technical knowledge or applications of knowledge throughout the world, which in the opinion of the council should be taken into account in the performance of the Minister's statutory duties, and it will keep under continuous review the whole field of fuel and power with the object of identifying problems needing research and development and advising the Minister of these problems with a view to discussion with the industries concerned.

Members of the Council

With the winding-up of the Fuel Efficiency Advisory Committee, the council is being invited to appoint a standing committee on fuel technology. The council's first chairman is Sir Alexander Fleck, FRS, until recently chairman of Imperial Chemical Industries, Limited, chairman of the former advisory council and chairman of the Minister's Nuclear Safety Advisory Committee which was set up as recently as June 28. Sir Alexander is also well-known as chairman of the Coal Board Reorganization Committee of 1953-1955.

The deputy chairman is Captain (E) W. Gregson, chairman of the Fuel Efficiency Advisory Committee, and a director of Spencer-Bonecourt-Clarkson, Limited, W.G.I., Limited, and West's Piling & Construction Company, Limited.

Other members of the council include Lt.-Col. S. J. M. Auld, a director of the Manganese Bronze & Brass Company, Limited, Oil Operated Gears, Limited, and other companies, as oil industry consultant; Dr. C. M. Cawley, chief scientist, Ministry of Power; Mr. T. B. Clark, Imperial Chemical Industries; Sir Josiah Eccles, deputy chairman of the Electricity Council; Mr. W. K. Hutchison, deputy chairman of the Gas Council; Dr. W. A. Macfarlane, managing director of the National Industrial Fuel Efficiency Service; Sir Harry Melville, secretary of the Department of Scientific and Industrial Research; Mr. L. Rotherham, member for research, Central Electricity Generating Board; Prof. M. W. Thring, Professor of Fuel Technology and Chemical Engineering, Sheffield University; Dr. F. A. Vick, deputy director, Atomic Energy Research Establishment, Harwell; and Mr. A. H. A. Wynn, scientific member, National Coal Board.

The assessors are Mr. P. Chantler, economic adviser, Ministry of Power; Dr. E. Lee, director of stations and industry divisions, DSIR, and Mr. H. T. Ramsey, director of the Safety in Mines Research Establishment, Ministry of Power.

Mining Qualifications Board

NEXT Mining Qualifications Board examination for first and second class certificates of competency as managers and undermanagers of mines will be held on November 15, 16, and 17, 1960, at Glasgow, Sunderland, Doncaster, Wigan, Cardiff, and Stoke-on-Trent. Candidates for limited certificates of competency as managers and undermanagers of stratified ironstone mines will attend at the Doncaster centre.

The Mining Legislation examination for mechanical engineer's certificates, electrical engineer's certificates, mechanic's certificates Class I and electrician's certificates Class I will be held at the above centres on November 15. The written part of the examination for certificates of qualification as surveyors of mines will be held at the above centres on November 16, and the oral and practical examinations in January, 1961.

Holders of the Higher National Certificate in mining surveying, or applicants who have passed the intermediate examination of the Royal Institute of Chartered Surveyors and are, therefore, exempt from the written examination must submit their applications not later than September 28, 1960. Intending candidates should apply after August 22 for the necessary forms, stating whether they have previously attended an examination for any of the above certificates.

The completed applications should be returned to the secretary as soon as possible, and must in any event be received not later than September 28, 1960. Letters should be addressed to the Secretary, Mining Qualifications Board, Ministry of Power, Thames House South, Millbank, London, S.W.1.

FOLLOWING THE REFUSAL of an application by the British Piston Ring Company, Limited, to expand its Coventry works, the company now intends to develop at Lydney (Glos).

Appointments

From Manchester to Edinburgh

SECRETARY to the North-Western Divisional Coal Board since 1955, Mr. J. A. FIELD will take over the duties of secretary to the Scottish Divisional Coal Board from September 1. Mr. Field, who is 46, worked for a year with a Fleet Street advertising agency before joining a London gas company as a chemist. He later moved to the company's research laboratories. On joining the National Coal Board in October, 1946, Mr. Field was on the administration staff of the scientific department at headquarters, eventually becoming departmental secretary before joining the North-Western Divisional Board.

He served with distinction throughout the war, taking part in the Dunkirk evacuation and later serving in North Africa and Italy. He was mentioned in despatches, made OBE in 1943, and awarded the US Legion of Merit. He is chairman of the Greater Manchester Association of Catholic Managers and Employers and a member of the committee of the Manchester branch of the British Institute of Management.

Mr. K. G. SMITH, at present secretary to the Scottish Divisional Board, is resigning to take up an appointment with the General Electric Company, Limited, in London.

Previously technical sales promotion manager of the carbon department of the Morgan Crucible Company, Limited, Mr. T. H. COOK has now been appointed chief applications engineer of the company.

Dr. G. L. J. BAILEY has been appointed manager of research at the London office of the Mond Nickel Company, Limited. He is succeeded as superintendent of the company's development and research laboratory in Birmingham by Mr. E. J. BRADBURY.

Mr. HERBERT LEONARD, manager of the Manchester coal department of the Co-operative Wholesale Society for the past eight years, has been appointed national manager. The society's four coal departments, at London, Bristol, Newcastle, and Manchester, now come under his control.

The Council of the Durham Colleges has approved a proposal to establish a Business Research Unit and has appointed Mr. A. J. ODBER as its director. Mr. Odber, at present Lecturer in Economics has worked for some years on problems of industrial relations and the distribution of industry.

Machine Tool Sales Agent in US

THREE more UK machine-tool makers have appointed the Lapointe Machine Tool Company, of Hudson, Massachusetts, as their sales agent in the US. They are Kitchen-Walker, Limited, Halifax (Yorks), H. W. Kearns & Company, Limited, Altrincham (Ches), and the Gear Grinding Company, Limited, Solihull (Warwickshire). There are now 12 UK machine-tool companies using the Lapointe engineering sales and service facilities in the US.

Last year Lapointe formed a subsidiary at Massachusetts, Lapointe Machine Company, to act as agent for the British machine-tool producers. Liaison between this company and the UK manufacturers is provided by another subsidiary, Lapointe Machine Tool Company, Limited, Watford (Herts).

Argentina Starts Up New Steel Plant

WHAT is designed to be the biggest steel plant in Latin America has been launched in Argentina, but engineers agree that it may also be the most uneconomical. Coal will have to be brought from the United States and ore from Brazil, Chile, or Peru and even farther abroad.

Argentina has some coal, which will be used experimentally in the blast-furnaces, but even this has to be carried some 1,500 miles from the Rio Turbio mines in Patagonia, and analysis has shown that it is in any case too "young" to be used alone. It will have to be mixed with imported coal in a proportion which has still to be determined, but probably between 2 per cent. and 15 per cent.

As to ore supplies, there is a long-term project to develop the untapped resources of the Sierras Grandes, in the province of Rio Negro, but this ore, too, is far from ideal and its iron content is likely to create technical difficulties.

It is hoped that the plant will become one of the main pillars for building up Argentina's heavy industry. It has been built on the banks of the Parana river, 200 miles from Buenos Aires, near San Nicolas. Its construction moved very slowly until 1956, when the Export-Import Bank granted it a loan of more than £20,000,000. Firing of the first blast-furnace took place in June, but since the capacity of the rolling mill will be three times that of the blast-furnace, considerable amounts of pig-iron will at present have to be imported, or produced elsewhere.

It has been stressed that the project is being carried out despite Argentina's political "ups and downs." Conceived during the Conservative administration which preceded the dictatorship of Juan Peròn, work on it was started under Peròn, carried on under the provisional Government of General Aramburu, and completed under the administration of Dr. Arturo Frondizi.

Awards for Newton, Chambers' Apprentices

AWARDS to encourage research and technical education in the gas industry are made each year by the Gas Plant Manufacturers' Development Council and nine of them have gone this year to apprentices from Newton, Chambers & Company, Limited, iron-founders, engineers, and chemical manufacturers, of Thorncliffe, near Sheffield. Presenting the awards recently, Mr. S. B. Rippon, general sales manager of the engineering division of the company and a member of the council, said that the company, one of the leading manufacturers of gasworks plant in the country, had been associated with the industry for 150 years. It was also a member of the council which is responsible for the awards, and grants and scholarships to universities every year.

Awards went to the following:—W. Gash, H. J. Godber, T. Tonks, F. Dean, R. Grantham, B. Walton, K. Taylor, R. Littledyke, and S. Ramage.

EXPORTS of coal, coke, and patent fuel through Hull in the four weeks ended June 19 totalled 40,054 tons, compared with 15,939 tons in the corresponding period of 1959.

First LD Process Steel

RTB PIONEER UK PRODUCTION AT EBBW VALE WORKS

FIRST steel produced in Britain by the LD A.C. top blown oxygen process was made last week at the Ebbw Vale works of Richard Thomas & Baldwins, Limited, and is now in production. The steel is stated to be at least equal to the best open-hearth deep-drawing steel yet made. The vessel installed at Ebbw Vale has a capacity of 30 tons and the plant represents an advance on most of those constructed, since it includes provision for the injection of powdered lime through the oxygen lance. Results are believed to augur well for the Spencer Works being built by RTB near Newport, where the LD process will be practised in the simplest form owing to the lower phosphorus iron available.

The new process is the latest in a line of developments which have been pioneered at Ebbw Vale. In the days of the old Ebbw Vale Works significant improvements were made to Sir Henry Bessemer's original process and more recently Ebbw Vale became the first works in Britain to adapt its Bessemer vessels for oxygen/steam, or oxygen-enriched air blowing.

In 1938 the first continuous wide hot strip mill in Europe went into production there, and this was followed in 1947 by the first electrolytic tinning line more than twice as fast. Ebbw Vale also pioneered the cold reduction of silicon steel for the electrical industry.

Inaugural Charging

Charging of the LD vessel for the first time was watched by Mr. Henry F. Spencer, managing director of Richard Thomas & Baldwins, Limited, who later sent a telegram of congratulation to all concerned in the plant's construction and commissioning. This work had been done jointly by the company's own engineering departments at Ebbw Vale and contractors working to the designs of the Austrian patentees.

Last year the company signed a licensing agreement with Brassert Oxygen Technik of Zurich for operating the LD process. Under this agreement, RTB will be able to make use of the extensive experience of the two firms who basically developed LD steel—Vereingte Oesterreichische Eisen und Stahlwerke of Linz (VOEST) and Oesterreichisch Alpine Montangesellschaft of Vienna (ALPINE).

Stainless Steel "Secret" for Archives

ENVELOPE containing a 30-year-old "secret" document left on his death by Mr. Harry Brearley, said to be the inventor of stainless steel, was opened recently by Sheffield Master Cutler, Mr. P. J. C. Bovill, and read to the Cutlers' Company.

Expectations that the document would throw new light on Mr. Brearley's discovery were not realized. Mr. Bovill said that there was nothing in the document that was not already known. "It is purely historical, and we will put it in our archives."

The declaration stated that the first bulk production of stainless steel was made in the works of Thomas Firth & Sons, Limited, in July, 1913. Cutlers were satisfied with its rustless qualities, but found the steel too hard to grind and polish.

Appleby-Frodingham's Blast-furnace Record

"QUEEN VICTORIA" blast furnace of the Appleby-Frodingham Steel Company, branch of the United Steel Companies, Limited, has beaten the record set up only a month ago by the company's "Queen Bess" furnace. For what is claimed to be the first time, a British blast furnace operating with 100 per cent. sinter burden has produced over 1,000,000 tons of iron. The campaign lasted for 112 weeks and is continuing. During this period the "Queen Victoria" has been charged with 2,570,000 tons of sinter containing 36 per cent. iron, 40,000 tons of scrap, and 820,000 tons of coke. For every ton of metal produced, 26 cwt. of slag is tapped so that the liquid output of the furnace so far during the campaign is 2,250,000 tons.

The stack lining is still in excellent condition. The furnaces are lined with MR2 super-duty firebricks manufactured by Morgan Refractories, Limited, a subsidiary of the Morgan Crucible Company, Limited,

Machine-tool Order-book Highest for Three Years

MACHINE-TOOL industry's total order-book was higher at the end of April than it had been at any time since the near-end of 1957. Value of orders in hand for the home market had risen to £58,800,000 and orders for export were worth £19,600,000. In April itself there was a fall in the value of deliveries to £6,400,000 (£8,900,000), but this is thought to show no more than the effect of the shorter month and the Easter holiday.

Net new orders coming in during the month are calculated to have fallen to £12,400,000 from £16,500,000, but in both months the net flow of new orders was almost twice the rate of deliveries, and the drop in April seems also to be seasonal. Taking the first four months of the year together, the increase in deliveries by the industry was 18 per cent.

OLDHAM HEALTH COMMITTEE is planning to have 659¼ acres of the town under smoke control orders by October, 1961.

In Parliament

COAL BOARD'S OBLIGATIONS

BRIEF but telling summing-up of additional obligations taken on by the National Coal Board, compared with the industry in pre-nationalization days, was given by MR. RICHARD WOOD, Minister of Power, in reply to MR. JAMES GRIFFITHS (Lab.), who asked for a detailed statement showing the cost to the NCB of its new responsibilities and services.

The board had a general statutory obligation to operate in the national interest, Mr. Wood stated. In consequence it had undertaken a number of responsibilities such as providing all the coal required in the public interest, including importing at heavy cost when necessary, and building up abnormal stocks of coal and coke to avoid redundancy and unemployment. The board's predecessors were not required by Statute to undertake these responsibilities.

Additional responsibilities had been placed on the board by legislation affecting subsidence damage, social welfare, and working conditions in the mines. NCB accounts showed the cost of these and similar activities, but it would be highly speculative to estimate how these costs compared with practice before nationalization or with what would have been the present practice if the industry had not been nationalized, he said.

CALL-UP OF EX-APPRENTICES

WHEN MR. STEPHEN SWINGLER (Lab.) asked what reply had been made by his department to a letter from Newcast Foundries, Limited, Silverdale, Newcastle-under-Lyme, concerning the granting of deferment of call-up to ex-apprentices in the machine-tool and allied industries, the MINISTER OF LABOUR, Mr. Edward Heath, said the firm had been told its employees did not qualify for deferment.

MR. SWINGLER said it was clear the Ministry had granted deferment to certain firms and not to others. Newcast Foundries was supplying certain parts to firms for making machine tools for exports, and the skill of all its men was vitally required to maintain production.

MR. HEATH replied that Newcast Foundries was a supplier for the machine-tool industry, but was not itself in the machine-tool industry. A firm requiring exemption had to be sponsored by another Government department showing that supplies would be affected because of limitations of suppliers if deferment were not granted. The firm mentioned had not been sponsored in this way, and he hoped it would no longer feel that it had been unfairly treated.

COMPENSATION TO FORMER COAL OWNERS

INTEREST on compensation for transferred assets—excluding Coal Commission Stock—paid to the Exchequer by the National Coal Board since vesting date has amounted to £83,819,087. The MINISTER OF POWER, Mr. Richard Wood, told MR. JOSEPH SLATER (Lab.) that the compensation payable and paid to former owners amounted to £291,997,000.

The amounts for the various valuation districts were as follow:—Northumberland, £16.745,000; Durham, £39,504,000; Cumberland, £1,117,000; Lancashire and Cheshire, £13,253,000; North Wales, £2,366,000; Yorkshire, £63,383,000; North Derbyshire, £21,420.000; South Derbyshire, £3,886,000; Nottinghamshire, £27,310,000; Leicestershire, £4,609.000; Shropshire, £772,000; Cannock Chase, £7,269,000; North Staffordshire. £8,007,000; South Staffordshire, £1,090,000; Warwickshire, £9,851,000; Bristol, £29,000; Forest of Dean, £919,000; Somerset, £841,000; Kent, £1,783,000; South Wales, £34,011,000; Scotland, £33,832,000.

The figures given include £164,660,000 in respect of coal industry value.

FUEL ADVERTISEMENTS

CONFUSION was being caused by the number of fuel advertisements claiming to be the best for industrial and domestic heating purposes, claimed MR. ROY MASON (Lab.), who asked whether a central agency could be set up to give advice on the use of fuels.

MR. RICHARD WOOD, Minister of Power, replied that the National Industrial Fuel Efficiency Service existed to advise on the use of fuel in industry and commerce, and there was not sufficient need for a Government agency to justify the expenditure involved.

OVER THE PAST three years the percentage of the total inland fuel consumption met by coal has dropped from 84 per cent. in 1957 to 76 in 1959. Oil percentage has increased from 15 per cent. to 23 over the same period.—The Minister of Power in a written reply to Mr. Alan Fitch (Lab.).

Gas for County Grid From RTB Works

GAS for domestic consumers throughout Lincolnshire will soon be pumped from the Redbourn Works, Scunthorpe, of Richard Thomas & Baldwins, Limited. More than 4,000,000 cu. ft. of gas produced at Redbourn's coke ovens, enough to supply a town twice the size of Scunthorpe, will be pumped daily to the East Midland Gas Board's works 1½ miles away. There it will be purified to remove hydrogen sulphide and then supplied throughout the county on a grid system.

The scheme has entailed the construction of mixing, pumping, and metering stations in the works' coke-ovens area and the Gas Board has already installed a new main from Redbourn to its own works. Mr. J. Harcus, fuel engineer at Redbourn Works, said that the plan will include a modern control system to mix in automatically a certain amount of blast-furnace gas. This will ensure that the gas supplied from Redbourn will be of the correct quality.

It is expected that another steelworks in Scunthorpe will be joining in the overall scheme, which includes a network of 180 miles of pipeline covering a large part of Lincolnshire. Two new batteries of coke ovens are now almost completed at Redbourn and when in operation these will supply much of the extra gas needed by the Gas Board.

Road coal lift from the South Yorkshire colliery of Woolley, near Wakefield, to the Redbourn Works is being organized to operate at the end of the month so that the coal-tipper plant can be stopped for repairs and overhaul.

To keep feeding the coke ovens at the works it will be necessary to transport 1,000 tons of coal a day by road, and plans are being made for 50 lorries to make two trips a day for 12 days. Coal deliveries from other sources will be cancelled during the period of repair, and the coke-oven department will only produce sufficient coke for blast-furnace use. No coke will be put to stock and this loss will be made up after the repairs are complete. The coal washery will not be fully operated during the repairs.

Steelworks for Persia

ANGLO-GERMAN CONSORTIUM'S £70,000,000 CONTRACT

AGREEMENT valued at about £70,000,000 for an Anglo-German consortium to build a large steelworks at Azna, northern Persia, has been signed. British partner in the deal is the Metallurgical Equipment Export Company, Limited (MEECO), and members taking part are Simon-Carves, Limited, the Electric Furnace Company, Limited, and the Wellman Smith Owen Engineering Corporation, Limited. Taylor Woodrow Construction, Limited, is also associated with the project. Besides the steelworks, which will have an annual capacity of 300,000 tons, the project includes an iron-ore mine and a town for 10,000 inhabitants. MEECO will be responsible for about one third of the deliveries to Azna.

Demag, in association with Krupps, heads the consortium. Other well-known German concerns in the group are Siemens, A.E.G., and Hochtief. For West German industry the Azna project will be the biggest of its kind since the building of the Rourkela steelworks in India, while as much significance attaches to the element of Anglo-German co-operation involved. There is no precedent for co-operation between the industries of Britain and west Germany on anything like the scale of Azna.

Demag announced last weekend that, with the initialling of the agreement, detailed contracts could be worked out and signed. No details were given of the price or the methods of finance. However, it is understood that the consortium has granted the Persians long-term credit facilities at an interest rate not exceeding 6 per cent. Both MEECO and the German concerns in the consortium have obtained the necessary export guarantees, but under the rules of the Berne Convention these must not run for longer than five years.

Final contracts for Azna are expected to be signed within a matter of weeks, so that preliminary work can begin next year at the latest. The project is expected to be completed by 1965.

Stockton Foundry to be Closed

FOUNDRY at the Parkfield works, Stockton-on-Tees, of Ashmore, Benson, Pease & Company, Limited, manufacturers of blast-furnace and gasworks plant, etc., is to be closed down at the end of the year. It was mainly used for making castings for the company's speciality plants, but with changing techniques casting is now of relatively minor importance and the company concentrates more on engineering work.

The foundry, one of the oldest departments of the company, has been working at a loss for some time and since present market conditions do not justify installing a new one, closure has been decided upon.

The 250 employees affected will be given three months' notice after which a run-down programme will be put into operation. Those employees who cannot be absorbed into other departments will receive special compensation.

Scottish Trade Group for Moscow

TRADE group representing 10 Scottish companies has left for Moscow with the aim of increasing Scotland's share of British-Soviet trade. Organized by the Scottish Council (Development and Industry) and led by Lord Clydesmuir, who will also be representing Colvilles, Limited, of which he is a director, the party will spend a week negotiating with the Soviet Foreign Trade Corporation.

The visit is a sequel to the signing of the Anglo-Russian Five-Year Trade Agreement in May last year, when the Scottish Council considered the best way to to turn the new and improved conditions of trade to Scotland's advantage.

Among those going are Mr. L. Spiro, director of Harland Engineering Company, Limited, makers of centrifugal pumps, generators and hydro-electric plant, of Alloa; Mr. John D. Lloyd, joint managing director of Mavor & Coulson, Limited, manufacturers of coal-cutters, loader and conveyor equipment, of Glasgow; Mr. T. Storray, director of Mirrlees Watson Company, Limited, sugar machinery, pumps and condensing plant makers, of Glasgow; Mr. J. A. Keyden, director and general manager of Pressed Steel Company, Limited, Paisley; Mr. C. S. McVey, sales manager of L. Sterne & Company, Limited, refrigerating machinery manufacturers, of Glasgow.

Mr. R. W. Lamont, chairman of Watson, Laidlaw & Company, Limited, chemical plant manufacturers, of Glasgow; Mr. A. C. Smith, sales director G. & J. Weir, Limited, engineers and makers of pumps, compressors and distilling plant, of Glasgow; Mr. John S. Young, managing director of John S. Young & Company, Limited, chemical plant and machine tool manufacturers, of Glasgow, and Mr. D. S. Reid, of the Scottish Council, who will act as secretary.

RISE IN 600 GROUP PROFITS

GROUP profits before tax of the George Cohen 600 Group, Limited, engineers, and iron, metal, and machinery merchants, rose from £1,308,109 to £1,573,315, and the net balance is up from £657,739 to £785,071, for the year to March 30, 1960.

The group is raising its final dividend by 1 per cent. to 8½ per cent., making 13 per cent. for the year, compared with 12 per cent. paid by the group for the previous year.

Law Cases

Payment of Open-cast Mining Rights

IN the Chancery Division Mr. Justice Cross dismissed an appeal by H. J. Rorke, Limited, Barnsley (Yorks), against the decision of the Special Commissioners that lump sum payments made by the company in respect of the right to enter upon land for the purpose of open-cast coal mining, were capital and not revenue payments and were not deductible under Section 137 of the Income Tax Act, 1952. A cross appeal by the Crown against the decision of the Special Commissioners that lump sum payments as compensation for diminution in value of the land and damage likely to be caused by the mining operations were made as a revenue and not capital account, was allowed.

The judge said that he could see no logical basis for the distinction made by the Special Commissioners between the two types of payments. It had been argued by the company that the operations and payments were normal and recurrent and that the operations were of a transient nature.

The Crown did not dispute this, but said that notwithstanding this the payments should be regarded as capital payments because what was being acquired was not stock in trade, or circulating capital, but rights to enable the company to get circulating capital (*i.e.* coal) for itself.

On the question of recurrence his lordship said that the company had in its favour a formidable finding of fact on the practice in the trade, but logically he could not see that recurrence made any difference. Although from the common sense point of view there was a great deal to be said for the company's argument, he had come to the conclusion that he should dismiss its appeal with costs, and allow the cross appeal, with costs.

ACTION OVER SUBSIDENCE

DAMAGE to a house at Porth (Glam) was due to mining operations, it was alleged at Pontypridd County Court, when the owners, Wincanton Transport & Engineering Company, Limited, claimed against the National Coal Board for the damage. The board is refuting the allegation, and claims that if subsidence had taken place it occurred before July 31, 1957, and it was therefore absolved from liability under the Coal Mining (Subsidence) Act of the same year.

The company, however, say the damage has been brought about since July, 1957.

A surveyor, Mr. Evan David Davies, of Thomas & Morgan & Partners, Pontypridd, said he and a partner investigated the property in September, 1958. "The whole of the building seemed to have been affected by ground movement, and we are of the opinion that the damage is due to past and present mining operations."

Mr. Paul Rasmussen, a foreman employed by the company, who has lived in the house since 1953, gave evidence of damage to the property.

The hearing was adjourned.

A DIRECTOR'S PAYMENTS

PAYMENTS made by H. Dunning & Company (1946), Limited, light engineers, of Audenshaw (Lancs), to one of its former directors, Mr. W. Hawke, in respect of an invention by him, were the subject of a case before Mr. Justice Cross in the Chancery Division. An appeal by the Crown against a decision of the Special Commissioners that the payments were not distributions within the meaning of Section 36 (1) (c) of the Finance Act, 1947, was allowed.

The Special Commissioners held that genuine commercial payments, other than loans at a commercial rate of interest, were not to be deemed distributions within the meaning of the sub-section.

Mr. Hawke, said his lordship, granted his company the right to manufacture and sell his invention in exchange for a "commission" of 7½ per cent. of the selling price of any articles manufactured and sold. The judge held that the payments were made under a commercial agreement for full consideration by Mr. Hawke in granting to his company a licence to exploit his patents and as such came within the sub-section.

£1,500 AWARD SET ASIDE

AWARD of £1,500 damages made last year to Mr. Benjamin Hands, a Motherwell steelworker has been set aside by the Second Division of the Court of Session. The court recorded a verdict in favour of defendant's employers, the Lanarkshire Steel Company Limited, Motherwell, on the ground that Mr. Hands had presented a case which was different to the one he had brought into court on record.

Last November, Lord Guthrie sent the papers in the case to the Crown authorities for investigation because he suspected perjury. Last week a witness in the action, Robert Hugh Veitch (21), pleaded Guilty to having given perjured evidence and was sentenced to six months' imprisonment.

AT LEEDS ASSIZES Mr. Justice Streatfeild awarded £1,000 damages and costs against the National Coal Board to Mr. George Randall (58) who was injured in an accident in 1954 at Snydale Colliery.

JUDGMENT BY CONSENT for £2,250 damages and costs was awarded against the National Coal Board to Mr. Mykta Andrijenko, at Leeds Assizes. Mr. Justice Streatfeild allowed the claim for personal injuries received by Mr. Andrijenko at Waterloo Main Colliery when his right hand and arm were trapped between the rollers of a conveyor belt, with the resultant loss of a thumb.

AWARD OF £274 DAMAGES to Mr. Alexander Coote, a steel erector employed by Dorman, Long & Company, Limited, was made at Nottinghamshire Assizes against the company, £74 of the amount being special damages agreed by the company for loss of earnings during the six weeks Mr. Coote was off work. He was hit on the head by a ½-lb. bolt which had dropped 150 ft. at High Marnham power station in February, 1959. Another claim for £196 special damages when the man was off work for a second time for 11 weeks was disputed by the company.

ANOTHER VICTORY FOR COAL

COAL is to be used again to fire the kilns of Swallow's Tiles (Cranleigh), Limited, which has produced hand-made tiles for the last 75 years. Some time ago oil burners were introduced which meant that 800 tons of Coventry coal a year were lost to the Coal Board.

Mr. H. Swallow, a director, said comparative fuel costs were about equal, but the firm's electricity bill more than doubled, and the quality of tiles deteriorated while oil burning was used.

NEWTON BROS. (DERBY), LIMITED—Mr. G. F. H. Hinings has joined the board.

Company News

BID FOR GRAHAM FIRTH

Brightside Engineering Offer Valued at £861,000

CONTRACT has been entered into by Brightside Engineering Holdings, Limited, to purchase 137,665 £1 shares of the £175,000 ordinary capital of Graham Firth Steel Products, Limited, Walsall (Staffs), on the basis of three ordinary Brightside 5s. shares, plus £1 15s. 6d. cash for each GFSP share. The 137,665 shares represent the holdings of the directors and other substantial holders in GFSP. Subject to approval of the terms, an offer on similar basis is to be made to the remaining shareholders.

Full acceptance would involve the issue of 525,000 Brightside shares and £310,625 cash, thus placing a value of some £861,000 on the GFSP business.

Brightside has already declared an interim dividend of 5 per cent. in respect of the year to September 30, 1960, and the directors forecast a final of not less than 12½ per cent. on the increased capital. It is estimated that group profits will be sufficient to cover the payments at least twice. Present resources are sufficient not only to satisfy the cash element, but also to provide GFSP with the additional capital required and to leave sufficient funds for the possible future expansion of the Brightside group.

GFSP intends paying before the amalgamation a final of 7½ per cent. for the year to April 2, 1960. Group profit before tax, amounted to £216,527 (£112,795) and it is stated that the present trading of the group is good and that profits of the parent and of the subsidiary, Metal Mouldings, Limited, are running at a higher rate than during the comparable period in the previous year.

DELTA METAL COMPANY, LIMITED—A one-for-eight rights issue of 3,420,000 5s. ordinary shares at 17s. 6d. each is to be made to ordinary shareholders registered on July 5. The issue will raise just on £3,000,000.

BEESTON BOILER COMPANY, LIMITED—Final dividend of 16 per cent. for the year ended March 31, 1960, makes 20 (17½) per cent. Net profit dropped from £150,768 to £132,460, after tax of £119,330 (£138,149).

DARTMOUTH MANUFACTURING COMPANY, LIMITED, ironfounders and boilermakers, etc.—Final dividend of 2d. per 1s. share makes 3d. for the year ended March 31, 1960, against nil for 1959 and 2d. for 1957-58.

LAFARGE ALUMINOUS CEMENT COMPANY, LIMITED—A final dividend of 1s. 6d. plus a bonus of 6d. makes 2s. 6d. per 5s. share (against 2s. 3d.) for the year to March 31, 1960. Net profit, after tax, is £166,022 (£119,944).

RUSTON & HORNSBY, LIMITED, engineers, steel and iron founders, of Lincoln—Group net profit for the year ended March 31, 1960, rose from £577,875 to £625,708, after tax of £361,227 (£403,070). The ordinary dividend is raised from 8 to 9 per cent., thus restoring the cut made a year ago.

TANGYES, LIMITED, makers of diesel engines, pumps, hydraulic machinery, etc., of Smethwick, Birmingham—The group net loss for 1959 was £28,019 (£73,201), increasing the debit forward to £73,620. During the first half of 1960 both orders and output were appreciably higher than last year.

ADAMANT & WESTERN ENGINEERING COMPANY, LIMITED, engineers, of Luton (Beds)—All the share capital of Charles S. Madan & Company, Limited, engineers and non-ferrous founders, of Altrincham (Ches), has been acquired for £165,000 cash and Adamant shares to the value of £56,000.

EDGAR ALLEN & COMPANY, LIMITED, steelmakers engineers, and founders, of Sheffield—Recent legislation will almost certainly occasion substantial additional capital expenditure within the next three or four years, states the chairman, Mr. W. H. Higginbotham. Group profit, after taxation, is £276,043 (£258,880).

NEWTON, CHAMBERS & COMPANY, LIMITED, engineers, chemical manufacturers, and structural engineers, of Thorncliffe, near Sheffield—The company has acquired all the share capital of Rhodes & Halmshaw, Limited, sheetmetal workers and ventilating engineers, of Ossett (Yorks). The authorized and issued capital of the company is £20,000.

GLOVER & MAIN, LIMITED—Referring to the purchase of all the issued capital of James Stott & Company, Limited, for £1,080,450, the chairman, Mr. P. D. Aird, said that it was a thriving concern and would fit well into the group. All the executive directors, including Mr. Vernon Stott, the managing director, would be continuing in the business.

CRITTALL-HOPE METAL WINDOWS (SOUTH AFRICA), LIMITED—For some years, states the chairman, Lord Braintree, the company has been trading near the limit of its borrowing powers and, although no further capital expenditure is planned, a wider range of raw materials makes it necessary to increase borrowing powers to £525,000 to meet future needs.

BROWN & TAWSE, LIMITED—A good start has been made for the current year, states the chairman, Mr. Miller H. Brown, with sales of steel products continuing at a high level. The outlook for the steel stockholding department is promising, and while prospects in the manufacturing sections cannot be viewed with equal optimism, there are indications of an improvement.

SAMUEL WILLIAMS & SONS, LIMITED, lightermen, etc., of Dagenham Dock (Essex)—Tonnage of coal handled during the year ended March 31, 1960, continued to decline, states the chairman, Mr. A. L. Williams. Group profit, including a dividend of 7 (5) per cent., from John Hudson Fuel & Shipping, Limited, increased by

£118,865 to £376,727. Net profit rose from £114,589 to £187,535, and the dividend is maintained at 15 per cent.

HICK HARGREAVES & COMPANY, LIMITED, general engineers, ironfounders, etc., of Bolton (Lancs)—Final dividend of 14 per cent. is being paid, making 18 per cent. for the year to March 31, 1960, an increase of 2 per cent. on the previous year's total, which included a bonus of 4 per cent. Consolidated profit after tax of £367,169 (£335,929) and after deducting profits of a newly acquired subsidiary company is £397,903 (£329,305).

RENOLD CHAINS, LIMITED—In his review, the chairman, Sir Charles G. Renold, says that demand for some products is again causing the board to plan further expansion, but it is expected that group resources are adequate to cover plans for the immediate future. With the aim of strengthening the group's competitive position in oversea countries a new sales subsidiary in Italy and a new manufacturing subsidiary in Canada are in process of being established.

BOULTON & PAUL, LIMITED, structural engineers, etc., of Norwich—The issue of further capital is being considered to provide the necessary cash for paying off the £600,000 bank overdraft and to finance the further development of the timber and steel business in the immediate future. It is proposed to issue 500,000 £1 shares and 4,000,000 5s. shares and the directors give their assurance that any additional capital not used immediately will not be issued to affect basically the control of the company without first consulting shareholders.

A. V. ROE CANADA, LIMITED—Continued economies have contributed towards improved working capital, states the quarterly report, but there has been no real improvement in the lowered sales expected in rail equipment, aeronautical, and coal operations. No dividend for the quarter is being declared on common shares. The last dividend of 10 cents a share was paid a year ago. The subsidiary, the Dominion Steel & Coal Corporation, Limited, has enjoyed an active and substantial order position for steel and steel products, but there are indications of slackening demand.

Winget Agreement With Gloucester Railway Carriage

DIRECTORS of Winget, Limited, engineers, ironfounders, and machine builders, of Rochester (Kent), have made a seven-year arrangement with the Gloucester Railway Carriage & Wagon Company, Limited, carriage and wagon makers, to use that company's surplus capacity at its Gloucester works. Gloucester is to put £300,000 into Winget's business. Winget's own shareholders will be asked to put up £162,000 by a rights issue which will be accompanied by a scrip issue.

Winget's business, it is explained, has expanded to the point where present manufacturing capacity is unable to cope with the current demand for its products. The company is also short of working capital. The directors of Winget expect profits, before tax, for the year to March 31, 1960, to exceed £265,000, compared with the previous £181,815. A 5 per cent. interim dividend has already been paid on £324,000 of capital and the final is to be 10 per cent. on £432,000 following the scrip issue.

For the year to March, 1961, the directors expect to recommend 12½ per cent. on the £594,000 of capital following the scrip and rights issue. An extra-ordinary meeting is called for August 4.

Local Coal "Too Dear" for Heating BMC Scots Plants?

IMPORTED oil may be used for heating the two new British Motor Corporation factories being built at Bathgate (West Lothian), despite the fact that the works will be sited on top of a coalfield. This is because the Scottish price of coal is said to be substantially higher than that BMC pays for coal delivered to its factories in the Midlands, said Mr. J. W. R. Penrose, director and general sales manager of the Austin Motor Company, Limited, on a visit to Motherwell last week.

A spokesman for the National Coal Board said later: "I don't know what quotations are being made to BMC. A plentiful supply of good coal will be made available to them at prices similar to those paid by all industrial consumers, whatever part of Scotland they are in. The coal produced in the pits adjacent to the BMC site is not suitable for their purposes. It is coking quality and it goes to coke ovens and gasworks."

Mr. Penrose also said during his Motherwell visit that the question of supplies of malleable castings for the manufacture of trucks, tractors, and diesel engines to be built at Bathgate was still to be resolved. The company had difficulty in getting these supplies in the Midlands and he wondered what the position would be in Scotland.

An official of the Carron Company, Falkirk, said later it had made an offer to BMC to build and equip a £2,000,000 factory at Falkirk to supply castings to the motor industry, but was still awaiting a reply.

Davey Paxman's Long-term Prospects

BY the close of the current year Davey Paxman & Company, Limited, manufacturers of diesel engines, boilers, rotary vacuum filters, etc., of Colchester (Essex) will come to the end of long-term Admiralty contracts for which, states the chairman, Mr. W. J. Ruston, it has particularly catered for many years. At least 15 per cent. of the turnover has come from this source over the last decade.

The problem of replacing this has now been faced, he states. The boiler and industrial plant division has been strengthened to handle additional products and on the engine side steps are being taken which will lead to more than the replacement of applications and markets which have recently diminished.

Net balance for the year to March 31, 1960, fell from £163,929 to £130,011, after tax of £61,984 (£145,413). The dividend is maintained at 10 per cent.

NEW PRODUCTION RECORDS FOR STEWARTS AND LLOYDS

LAST week saw the setting up of two new production records at the Bilston (Staffs) iron and steel works of Stewarts and Lloyds, Limited. Output of iron from the Elisabeth blast furnace was 5,949 tons, compared with 5,602 tons in the week ended June 11, and 11,006 tons of ingot steel were produced at the open-hearth plant, compared with 10,035 tons in the week ended April 7.

Output of ingot steel from the company's open-hearth plant at Corby (Northants) last week was a record at 5,637 tons—129 tons more than the previous best.

IRON AND STEEL TRADE

HOME production of cold reduced sheets is still unable to cope with the continuous pressure of demand. It is a pity, in many respects, that imports have to be called upon but there is no doubt that substantial quantities of American sheets are easing the position. The labour situation shows little sign of immediate improvement and in many sections of the trade producers are not securing maximum outputs because of the shortage of skilled workers.

Pig-iron

The general position governing the ironfoundries shows little change and those catering for the motor car industry, makers of heavy vehicles, and the general engineering trades continue exceptionally busy. Although considerable quantities of low phosphorus, hematite, and refined pig-irons are being taken up, no shortages are reported and, in fact, outputs could be increased if the demand warrants it.

There is plenty of high phosphorus pig-iron available for the light foundry industry and for the textile machinery trade. Those foundries catering for the building industry continue fairly busy.

Ferro-alloys

The price of ferro-tungsten remains unchanged, and the demand is fairly quiet. Ferro-vanadium is quite active and there is a fair request for ferro-molybdenum. Both the 45 per cent. and 75 per cent. Si grades of ferro-silicon are in good demand, and ferro-chrome also is of steady interest.

The specialized interest in ferro-sulphide and ferro-phosphorus is maintained. Calcium silicide is fairly active, and there is a good demand for ferro-manganese and silico-manganese.

Moderate support is given to ferro-niobium and ferro-titanium.

Semi-finished Steel

The re-rollers have good order-books for light sections, bars, strip, and reinforcing bars, and it is as well that the supply of billets is, at any rate for the moment, adequate to meet their needs. Supplies of billets from home makers have kept up well in recent weeks and, supplemented as they are by Canadian billets, principally in the 2-in. sizes, the situation is reasonable.

As the supplies of prime billets are becoming more plentiful there is a noticeable difficulty in disposing of defectives and crops. However, stocks of these are not heavy.

Finished Steel

Despite the fact that plate production is maintained at the highest possible level, demand is still heavy, especially for the lighter thicknesses. Most consumers are looking forward to the latter part of the year when new plant should provide greater capacity.

Due to heavy existing commitments, makers are having to extend their rolling promises for many sizes of steel sections, but there is no diminution in demand. Bright drawn bars in good commercial qualities are fairly easy to obtain, but lack of free cutting and alloy grade bars is still holding up execution of outstanding orders

Additional tonnages could easily be absorbed by makers specializing in colliery requirements such as arches, pitprops, light rails, etc., and there is capacity available both in their forward and current programmes.

£58,000,000 Steel Plant for Algeria

AGREEMENT was signed on Tuesday between the French Government and the French Steel Industry Federation for the setting up at Bône, in Algeria, of a steelworks which when completed will be capable of producing 500,000 tons of steel a year. The plant is to be built over the next four years by the Bône Steel Company, and of the NF 820,000,000 investment (£58,000,000) required for its construction, 51 per cent. will be provided by the French steel companies, 20 per cent. by the Ouenza Mining Company in Algeria, and the remainder by banks in France and Algeria.

The French Government will provide an equipment bonus of NF 240,000,000, of which only NF 40,000,000 will be repayable.

There will be an ore-processing plan, a steel furnace and a sheet steel mill, as well as power stations and secondary industries, whose cost is not included in the steelworks plan. Production is planned to begin by the end of 1962.

Triplex to Acquire Eclipse Foundry & Engineering

SUBJECT to the successful outcome of negotiations, the Eclipse Foundry & Engineering Company (Dudley), Limited, and its subsidiary, Eclipse Metal Industries, Limited, will shortly join the Triplex Foundry, Limited, group of companies. The Eclipse companies make castings for the engineering industries in grey iron and aluminium and other non-ferrous metals. Its other activities include general machining, fabrications, and assembly.

The existing directors of Eclipse, Mr. A. C. Sheldon, and Mr. J. E. Richards, will remain on the board and thus ensure continuity of management.

"*Mining Should Employ More Geologists*"

PROSPECTS for newly-qualified geologists are "precarious," and more should be employed by British industry, particularly in mining, says Prof. David Williams, president of the Institute of Mining and Metallurgy. In a review on "manpower," Prof. Williams points out that 240 Britons will soon be taking honours degrees in geology and an equal number are now doing post-graduate research.

Several UK industries would benefit from employing more geologists, Prof. Williams claims, and "certainly not least the mining industry."

Non-ferrous Metals

Ramifications of Congo Troubles

THE deterioration in the Belgian Congo situation has made for a firm copper market in London. At the beginning of the week the Union Minière du Haut Katanga ceased production and prices in London rose sharply. Why the mine closed down is not clear, but it would appear that the present Congo Government does not intend to nationalize the mines. However, Union Minière is to transfer its registration to Brussels, and to set up subsidiaries in the Congo as soon as practicable. In any event, the situation in the Congo is likely to influence the copper markets for some considerable time ahead and it may well be that the tendency for prices to decline in the holiday period will be offset.

Stocks of refined copper in LME warehouses rose last week by 295 tons to 3,375 tons. In the US the market is affected by the holiday period, but the price structure is unaltered with 33 cents a pound being applicable to both producers and custom smelters.

Tin is a firm market in London, in Singapore, and in New York, where the price is near $1.03 a pound. The situation in the Congo is a sustaining feature in this market, too, but, nevertheless, the price level is being maintained at well over £800 a ton by the good persistent demand in all three centres. Stocks of tin in LME warehouses rose last week by a further 301 tons to 9,041 tons.

Lead continues to be a quiet market on both sides of the Atlantic. This is partly due to the holiday period, but also because it is thought that the restrictions on supplies will be raised following the next meeting of the Study Group in Geneva in the early part of September. In the US the price is unchanged at 12 cents a pound.

Zinc continues firm in London and quiet in New York where the price is still called 13 cents a pound. World consumption of zinc is at a high level and it is thought that the price in London may well go higher once the holiday period is over.

Official metal prices in London yesterday (Thursday) were:—COPPER, Standard: Prompt £257 10s., forward £250. TIN, Standard: Prompt £809, forward £806. LEAD: Prompt £70 7s. 6d., forward £71 17s. 6d. ZINC: Prompt £90, forward £90 7s. 6d.

Fluctuations in Copper Prices

PROPOSALS for reducing fluctuations in the price of copper and to resist inroads of substitute materials have so far met with little progress. The British Non-Ferrous Metals Federation feels that producers could do much to reduce the London Metal Exchange fluctuations by maintaining adequate stocks in consuming countries, and a memorandum on the subject by principal importers says producers have now recognized the need for the creation of emergency stocks at various points.

The federation has also suggested that producers should market more copper through the London Metal Exchange, and that they and the consumers should co-operate to make it more effective. The latter suggestion has so far not been acceptable to producers.

New Aluminium Rolling Mill for Ghana

ALUMINIUM rolling mill costing £1,000,000 is to be installed by Ghana Aluminium Products, Limited, next to its present factory at Tema. When completed, it will eliminate the need to import into Ghana many semi-fabricated aluminium products. Specially designed machinery and equipment will be used, and when installed will be able to serve the entire market requirements of Ghana, with additional capacity for development of an export market.

The new rolling facilities are expected to be installed and in operation early in 1962. Initially the mill will use imported aluminium ingot, but if the Volta River Project, involving the establishment of an aluminium smelter, goes ahead the mill would be able to use Ghanaian ingot.

Ghana Aluminium is a company jointly owned by the Ghanaian Government and Aluminium, Limited, of Canada. Arrangements are nearing completion for the additional share capital required to finance the rolling mill to be provided by Aluminium, Limited, the Commonwealth Development Finance Company, Limited, the United Africa Company of Ghana, Limited, Compagnie Française de l'Afrique Occidentale, and the Union Trading Company, Limited, with the Government of Ghana retaining its existing investment.

The Commonwealth Development Finance Company may also supply part of the additional long-term capital which will be needed by the company. Arrangements will be made whereby, when the rolling mill is in full operation, shares in the company will be available for investment by the Ghanaian public.

The new plant will employ 200 Ghanaians, many in key positions. The installation of the mill will be the second expansion of the plant at Tema which started production of roofing sheets in August, 1959, and has already built a second factory in which to produce a wide range of aluminium products.

MEMBERS OF NUCLEAR SAFETY COMMITTEE

NUCLEAR safety advisory committee has been set up by the Minister of Power, Mr. Richard Wood, under the chairmanship of Sir Alexander Fleck, FRS, who recently retired as chairman of Imperial Chemical Industries, Limited. Other members of the committee include:—

Dr. T. E. Allibone, director of the research laboratory, Aldermaston, of Associated Electrical Industries, Limited; Mr. G. F. Bullock, general manager of Vulcan Boiler & General Insurance Company, Limited; Dr. S. C. Curran, FRS, principal of the Royal College of Science and Technology; Prof. J. Diamond, Professor of Mechanical Engineeering, Manchester University; Mr. P. T. Fletcher, deputy managing director of the development and engineering group of the Atomic Energy Authority; Sir Willis Jackson, FRS, president of the Institution of Electrical Engineers, and director of research and education of Associated Electrical Industries (Manchester), Limited. Mr. R. E. Newell, managing director of the Wilton works of Imperial Chemical Industries, Limited; and Col. G. W. Raby, managing director of Atomic Power Constructions, Limited.

The Importance of CARBON DEPOSITS

By H. E. COLLINS*

C.B.E., M.Eng., M.I.Min.E., A.M.I.E.E.

The utilization of the various sources of carbon over the past few years has shown a marked change both in pattern and extent throughout the world, and Great Britain has been no exception. In this paper, which he presented at the annual conference of the National Association of Colliery Managers at Southport on June 1, the author says that these changes are likely to continue, perhaps at reduced rates, but nevertheless the British coal industry is faced and will continue to be faced with intensive competition.

THE title of this address might, at first glance, appear somewhat remote from the theme of this conference, but it seemed necessary to review the future of coal against the background of world sources and usage of carbon. Moreover, it will be advantageous and of some interest to appraise the likely trends of carbon requirements of which, on a world basis, coal supplies over half of the total consumption.

Carbon is indispensable to all forms of life and, quite apart from this, in its multiplicity of varied compounds, carbon is a most important factor in our standard of living. Even aside from our very existence, the effect of the complete absence of carbon, or, indeed, its acute shortage, defies the imagination. It would be no exaggeration to describe carbon as one of the most important elements occurring in nature.

OCCURRENCE

In considering the earth's structure it might appear strange indeed to regard carbon as a "trace" element. Nevertheless, this is demonstrably true, since carbon, in all its forms, constitutes no more than 0.04 per cent. of the earth's total bulk. Moreover, the carbon content of the earth's crust down to a depth of 5,000 metres is considered not to exceed 0.1 per cent., and of this proportion only a very small fraction occurs in a reactive form. Quite a large amount occurs in the form of carbonates and other compounds of carbon which are not directly reactive with oxygen, and such compounds are not discussed in this paper.

Most of what may be termed "reactive" carbon occurs in nature in concentrated form as fossil fuels, peat, lignite, coal, mineral oil, and natural gas. There are also limited deposits of graphite and, of course, gem and industrial diamonds.

The distribution of the resources of solid fossil fuels is fairly wide, but somewhat unequal, throughout the world. North America and the USSR are reputed to have over 60 per cent. of the probable world resources of coal and a somewhat higher percentage of lignite and peat. There are also very large reserves in China. Over the years many attempts have been made to estimate the world's probable reserves of coal. This is a very difficult exercise and any figures can be no more than extremely approximate. It is perhaps even more difficult to provide any satisfactory estimation of workable reserves, because economic conditions and improved techniques in mining in the future could well vitiate any estimates made today. Current thinking in respect of probable world reserves gives the following figures:—

Coal	4 to 5 $\times 10^{12}$	metric tons
Lignite	1 to 1.3×10^{12}	" "
Peat	1 to 1.2×10^{11}	" "

These figures relate to seams at least 30 cm. thick down to a depth of 1,200 metres. Except to say that workable reserves must necessarily be well below the figures for probable reserves, it would be very hazardous to suggest even approximate figures. Of the coal reserves mentioned above it might be safe to suggest that some 25 per cent. is actually proved.

Considering Great Britain only, the workable coal reserves are estimated at over 100,000,000,000 tons.

Since peat occurs at the surface and lignite at no great depth, more reliance can be placed on their estimated reserves.

Mineral oil resources are distributed in a much more unequal manner throughout the world than is the case with solid fossil fuels, although recent discoveries in the Sahara and Libya have somewhat widened the distribution. The richest fields are in America, the Middle East, and the Soviet Union. If the estimates of the probable reserves of coal need to be regarded with some caution, this applies with much greater force to oil and natural gas. Proved reserves of oil are in the region of 4×10^{10} metric tons. Records show that this figure exceeds the total amount of oil extracted to date. Probable reserves of mineral oil can be regarded as in the order of 25×10^{10} metric tons.

* Member for production, National Coal Board.

Another source of mineral oil is by distillation of oil shales and bituminous sands which on average have a bituminous content of about 5 per cent. As the Scottish oil shale industry has clearly demonstrated, oil distilled in this manner is not competitive with the natural product. However, if it were commercially possible to recover oil from the probable reserves of shales and bituminous sands, these fuel reserves might be in the order of 5×10^9 metric tons. The greater part of these reserves lies in North America.

Natural gas is usually, but not exclusively, associated with oil deposits. Coal seams and associated strata, as we well know, contain accumulations of natural gas which constitute a serious mining hazard. The introduction of methane drainage as a safety measure in the winning of coal has made available considerable quantities of natural gas. Again, quite large volumes of natural gas are being obtained annually in the Po Valley in Italy, Lacq in south-west France, and the Sui field in Pakistan. There are, of course, vast reserves in the Soviet Union, America, the Middle East, and Africa.

It is really impossible to give any reliable figure for the probable reserves of natural gas. A figure for world resources of 15×10^{10} metric tons has been suggested, but this merely indicates an order of magnitude.

In the context of carbon resources natural graphite must be mentioned, but the demand for graphite far exceeds the production of the natural product, and a considerable quantity is now produced artificially from normal high-grade coal or coke, petroleum coke, or carbon black by subjection to high temperature.

Even having regard to the somewhat tentative estimates for the world reserves of fossil fuels, there can be no doubt that the reserves of coal are substantially greater than those of oil and natural gas. This will inevitably give rise to important long-term consequences. It means, at the very least, that coal technology is more important in world affairs than oil technology. This aspect has been clearly recognized in the USA, where in the last decade or so considerable expenditure has been incurred, both by the Government and by private industry, in coal research and process development. Recently the US Government has proposed a further financial commitment for a research programme in the uses of coal involving the expenditure of about £17,800,000 over the next 10 years.

If the subject of coal research and the development of processes for coal utilization are regarded as of such importance in the USA, where there are extensive reserves of oil and natural gas, with how much greater force does this apply to Great Britain, where coal is almost the only indigenous fossil fuel?

THE USES OF CARBON

Primary Fuels

The preponderant use of fossil forms of carbon is the provision of primary fuels. For example, in Great Britain, about 75 per cent. of the total consumption of coal represents direct burning in its raw state. The main users in this connection are electricity, domestic, railways, and general industry. Similarly, a large proportion of lignite and, to a limited extent, peat, is burnt in the raw state. With regard to lignite, with which is included brown coal, this applies particularly to power generation in Europe and elsewhere, where large electricity generating stations are operating on raw lignite. In the domestic sphere and, to a limited extent, railways, the lignite is first processed into briquettes, but this merely means the elimination of the high proportion of moisture and compacting under pressure and heat without the need for a binder to give a handier form of fuel.

With mineral oil, processing is generally necessary and the kerosene, light and heavy oil fractions are used as direct fuels.

Natural gas is also used as a direct fuel in countries with plentiful supplies, and there is the possibility of much wider use should refrigerated transport and extensive undersea pipelines become commercially viable operations.

Secondary Fuels

The carbonization of solid fuels provides the source of secondary fuel in the form of town's gas. The heating of coal and coke with air and air/steam mixtures gives producer gas and water gas used in numerous industrial processes. Similarly, the complete gasification of coal, lignite, and peat with steam/oxygen mixtures produces a relatively lean gas which can be used for industrial processes in its crude state or as town's gas after purification, enrichment, and density modification.

Electricity is also a form of secondary energy, derived mainly from the combustion of solid fuels, but also of oil, natural, or manufactured gas. Hydro-electric generation, although not significant in Great Britain, is of considerable importance in various countries of the world.

The refining of oil also provides secondary fuels, some of which are mentioned above, but in addition quite large quantities of tail gases are available which, after appropriate re-forming, are suitable as town's gas. In addition, some of the products of distillation can be cracked and utilized as town's gas and for the manufacture of carburetted water gas.

Natural gas, which has a high calorific value, is being used, after re-forming, in this country and elsewhere as town's gas where the standard calorific value of the normal supply is roughly half that of natural gas. A future possible use of natural gas is for the enrichment of lean gas produced by the complete gasification of coal.

Metallurgical Application

Metalliferous ores are usually found and mined in the form of sulphides, oxides, and carbonates. Gold and silver generally occur in the native state. Carbon is the most widely used element in the reduction of ores to produce the associated metals. Notable exceptions are nickel, copper, lead, and sodium. A very small fraction of iron production is achieved by reduction with hydrogen, but

this amounts to no more than 0.1 per cent. of world production.

Generally, smelting processes require heat not only to ensure the correct reaction temperature, but also to meet the heat loss of the reduction process, which is generally endothermic in character. Now carbon supplies the necessary heat and is available as a chemical reagent to achieve the reduction reaction. Almost universally the carbon is made available in the form of metallurgical coke, which provides an outlet for large quantities of coking coal. In addition to its roles in the blast furnace of fuel and chemical reagent, carbon is an essential constituent of steel, to which it gives strength.

Another very important application of carbon in the field of metallurgy is that of a refractory material. For this purpose carbon and graphite are used substantially in the pure state. The basic material from which the refractory is to be produced is mixed with a carbonaceous binder, usually coal tar or pitch. In this form the material is plastic, and can be shaped according to its ultimate use either by extrusion or by moulding. The resulting article, block or tube, etc., is baked at temperatures ranging from 650 deg. C. to 1,300 deg. C. The binder is carbonized, and the finished article will be pure carbon or a mixture of carbon and graphite. Still further conversion to artificial graphite may be obtained by heating to higher temperatures in the order of 2,500 deg. C. to 3,000 deg. C. in electrical resistance-type furnaces.

Carbon and graphite are excellent refractories where high temperatures, say, exceeding 1,500 deg. C. are required, but they may only be used in non-oxidizing atmospheres. Carbon bricks are now used for blast-furnace linings and also to form a floor of graphite in electric-arc furnaces used for the manufacture of phosphorus.

Graphite refractory materials are used in a variety of forms such as ingot moulds, crucibles, and dies. Special crucibles for melting copper and aluminium alloys are produced from the mixture of carbon or graphite with other refractory materials, particularly silicon carbide. There are also clay-bonded graphite refractories incorporating some granular refractory material, usually silicon carbide. These are prepared by hand or machine moulding of the plastic material and baked at high temperature. The finished material is not easily machined and usually the article must be moulded initially to its final shape.

Electrical Uses

The uses of carbon and graphite in the electrical field are very numerous. Brushes for electric motors and generators spring readily to mind. Electrolytic applications are also extensive in the form of anodes and cathodes in the production of aluminium, sodium, and other metals. Gases produced by electrolysis include chlorine and fluorine, and if electricity were cheap enough the process could be used for hydrogen and oxygen.

The electro-thermal applications are widespread, principally because of the resistance of carbon and graphite to thermal shock combined with good electrical conductivity and reasonable mechanical strength at high temperature. The more common use is in the electric-arc furnace employed extensively for the production of special steels which require close control of temperature. Graphite resistor furnaces are applied to processes requiring very high operating temperatures.

Mechanical Engineering

The oil-less bearing is now widely adopted where ordinary lubrication is difficult. The self-lubricating properties of graphite render this substance most suitable for this purpose. Mechanical carbons are used for bearings subjected to high temperature or to the action of corrosive liquids. The use of carbon or graphite for seals associated with pump and turbine shafts is also important.

Having regard to the fire and explosion hazards associated with the use of lubricating oils in compressors, carbon and graphite can be used for piston rings, thus obviating the need for cylinder lubrication.

Chemical Industry

Perhaps the most extensive use of carbon in the chemical field, apart from coke as a reducing agent, to which reference has already been made, is in the form of synthesis gas. This is a mixture in varying proportions of carbon monoxide and hydrogen. Synthesis gas is manufactured by direct gasification of coal or coke and petroleum liquid products or by re-forming of oil-refinery tail gas and natural gas.

Obviously, the coal industry is vitally interested in the use of coal and coal derivatives in this important chemical field. The recent interest in the complete gasification of coal opens up a much wider scope for chemical application. It must, however, be emphasized that the amount of coal likely to be required for direct use for chemicals is limited, possibly little more than 2,000,000 to 3,000,000 tons per annum, compared with the current use of a little over 1,000,000 tons per annum for this purpose.

The manufacture of methanol and ammonia is a well-known process dependent upon synthesis gas. It is also technically possible to use this process in Fischer-Tropsch plants for the manufacture of oil from coal. Under conditions now prevailing in Great Britain, particularly with regard to the relative price of imported mineral oil and coal, and also current costs of producing synthesis gas, it would appear not to be a commercially viable venture.

Acetylene gas is a most important industrial chemical. Quite apart from its familiar application in welding and metal cutting, acetylene provides a route for the synthesis of many important products, one of which will be very familiar to mining men, the plastic, polyvinyl chlorine (PVC). The gas is made by the reaction of water with calcium carbide and this chemical is made in Europe almost entirely from coke.

Another carbide of great value to industry is silicon carbide, which is produced by heating a

mixture of crushed coke and sand in an electric furnace. The use of silicon carbide as an abrasive and for hard-facing of cutting tools is well known, but perhaps not so widely realized is its use in conjunction with carbon or graphite in producing refractory articles as already stated.

The production of artificial silk or rayon by the viscose process utilizes carbon bisulphide. This chemical is made by heating coke with sulphur.

As already mentioned, the world production of aluminium is entirely dependent on carbon, since it is produced by the electrolysis of its fused oxide (alumina) between carbon electrodes. The carbon has a chemical function as well as that of an electrical conductor. The world aluminium industry consumes something in the order of 1,500,000 tons of anode carbon annually.

Carbon black is another form of pure carbon which finds many uses. Printer's ink is very familiar. However, the main usage of carbon black is in the process of rubber vulcanization. Unfortunately for the coal industry, carbon black is principally made by the partial combustion of natural gas and petroleum. However, tar oils and manufactured gas may also be used for its production.

The inertness of carbon and graphite to corrosives and to many gases, excluding oxygen, makes carbon in these forms of particular importance in chemical processing. However, the use of carbon in chemical plant construction has been limited because of its porous and permeable characteristics. While the porosity of carbon is an advantage in many chemical processes, numerous applications involving heat exchange require an impermeable material with high thermal conductivity. It has been possible recently to meet these requirements by the impregnation of carbon and graphite with liquid organic resins, although possible decomposition of the impregnating material generally limits the maximum operating temperature to about 180 deg. C.

Nuclear Plants

The current design of nuclear plants for the generation of electricity is based on the Calder Hall reactor, which is gas-cooled, graphite moderated. Thus, the cores of the reactors are of graphite construction and many thousands of tons will be required for the plants under construction and programmed by the Central Electricity Generating Board. The Dounreay plant, which incorporates a fast breeder-type reactor, will use boron-impregnated graphite as a thermal shield.

General

The foregoing survey of the uses of carbon in industry can by no means be regarded as exhaustive, but the mere recital of some of the manifold applications of carbon should serve in no small measure to emphasize the importance of this most necessary element. That coal is the source of such a large proportion of the carbon used in industry should provide much encouragement to all engaged in coal mining and associated activities.

Except for the metallurgical industry and the use of carbon as a direct fuel, the numerous uses of carbon in industry taken individually provide relatively small outlets for indigenously produced coal. Small though the tonnage of pure carbon required by industry may be, when compared with the total output of coal, it is amply compensated by the high value of this material.

It will be clear from the above appraisal of carbon in industry that there are competing sources of supply, and among these we must now consider the place of coal.

CONSUMPTION OF PRIMARY FUELS: THE CHANGING PATTERN

In all informed circles the view is unanimous that consumption of primary fuels will continue to rise. Somewhat divergent views are, however, current regarding the pattern of distribution between the various forms of such energy.

In the field of electricity generation it seems clear that the demand for coal will continue to rise in this country and throughout Europe. Indeed, in America the picture is not markedly dissimilar.

In the United Kingdom, unlike Europe and America, there has been much emphasis over the past few years on the application of nuclear energy to electricity generation. The current programme of nuclear stations provides for a total generating capacity by 1965 of some 1,800 megawatts. More recent appraisals of the economics of nuclear power cast doubts on its ability to compete with coal-fired thermal stations in the foreseeable future. It is only fair to add that the power generation programme over the next five years provides for an additional capacity of over 9,500 megawatts from new coal-fired thermal stations. On the continent of Europe doubts on the economics of nuclear power have long been entertained and there is now far less enthusiasm for nuclear station development than even when Euratom was constituted. Recent visits to Poland and Czechoslovakia have revealed that electric power generation will continue to be firmly based on thermal stations fired by brown coal, and, of course, this fuel is similarly used extensively in other European countries.

The steel industry continues to pursue a policy of expansion and, despite considerable advances in operational efficiency, will require increasing quantities of coal and coke. If cheap, dry hydrogen could be made available it might provide a formidable rival to coke in the reduction of metallic ores; but this would appear to be no more than a remote possibility.

The gas industry is regarded as a decreasing outlet for coal, but complete gasification of coal for the manufacture of industrial and town's gas and, possibly, synthesis gas might well at least stabilize the market at a level not markedly different from that prevailing today. However, it would be unwise to place too much reliance on this possibility.

Other industries provide a situation which ex-

poses the vulnerability of coal to oil encroachment, but much of this might well be avoided by the provision of relatively cheap industrial gas. This gas would have to be provided in such a way as to be particularly attractive to industrial processes. This would involve either a distinct industrial gas grid or a grid system combining supplies of relatively lean gas for industry and town's gas derived from it by enrichment and appropriate modification at selected load centres.

Current thinking on the future of the various forms of primary energy is perhaps epitomized in the recently presented report of an advisory commission of the Organization for European Economic Co-operation (OEEC) entitled: "Towards a New Energy Pattern in Europe." While in no way subscribing to all the implications in this report, it might be of interest to set out the salient features.

The estimates (Table 1) imply an annual growth in total gross national products of the OEEC area of approximately 3 per cent. and a corresponding increase in the demand for primary energy of just over 2½ per cent. per annum.

TABLE 1.—*Estimate of Total Demand for Primary Energy in the OEEC Area.*

	1955.	1965.	1975.
Million tons of coal equivalent	777	970–1,050	1,225–1,425
Index	100	125– 135	158– 183

It is clear that the commission expects the greater part of the anticipated increase to be met by oil, natural gas, lignite, and, to a limited extent, nuclear energy. This is clear from the estimates of hard coal production in the OEEC area.

TABLE 2.—*Estimates of Hard Coal Production in the OEEC Area (Million Metric Tons).*

	1955.	1965.	1975.
European Coal and Steel Community	247	230–250	220–260
United Kingdom	225	205–220	200–225
Others	5	5– 10	10– 10
Total	477	440–480	430–495

Oil, which in 1955 provided 21 per cent. of total primary energy, is expected to supply 30 per cent. to 32 per cent. in 1965 and 35 per cent. to 39 per cent. in 1975. This represents an increase in estimated oil consumption from 106,600,000 tons in 1955 to 390,000,000 tons in 1975.

The use of natural gas has increased considerably and its production in Europe has increased twenty-fold during the past 12 years. The difficulty in forward estimating is not one of production, but of distribution. The commission estimates that production of natural gas in Europe will increase from 7,000,000 tons of coal equivalent in 1955 to 25,000,000 tons in 1965 and between 50,000,000 and 60,000,000 tons in 1975. These figures leave out of account imports of natural gas, particularly the possibilities of the French-controlled Saharan gas.

The extensive utilization in Europe of lignite or brown coal for electricity generation, town's gas production, and chemical uses is reflected in the estimates of production from 30,000,000 tons of hard coal equivalent in 1955 to 45,000,000 tons in 1965 and 60,000,000 tons in 1975.

The overall estimates envisage marginal changes in hard coal production, but a considerable reduction of its share in the total energy demands. Thus, in 1955, hard coal contributed in the OEEC area 68 per cent. of total energy consumption. The report suggests that the figure will fall to 46 per cent. in 1965 and still further to 35 per cent. in 1975.

The pattern of fuel consumption in Europe generally differs very much from that in Great Britain, in particular in that our proportionate consumption of hard coal has been and will continue to be much higher than the figures quoted for the OEEC area. Thus, in 1946 coal's share of energy consumption in the United Kingdom was 92 per cent., but had fallen to 80 per cent. in 1958. The downward trend in the proportion of coal to total primary energy likely to be consumed in our country in the future might well continue, but not at such a rapid rate as is envisaged for Europe generally. However, having regard to the anticipated growth in total primary energy requirements in this country, it is expected that the demand for coal will be maintained, and production in 1965 and 1975 should be marginally higher than at the present time.

My general comment on the OEEC report is that the commission has been unduly influenced by current thought on the feverish expansion in the use of oil with total disregard of national economics. It completely ignores the importance of indigenous coal, and it is my firm conviction that the countries of Europe could only neglect natural and national energy sources at their peril. Any idea of abandoning preservation and development of indigenous coal resources would, if pursued, bring a day of reckoning when, as the commission freely admits, the increasing use of oil begins to exhaust the admittedly limited oil resources of the world.

Future Prospects for Coal in Great Britain

The immediate future for coal is clearly set out in the "Revised Plan for Coal," details of which form the subject of other papers being presented to this conference. The achievement of these relatively short-term plans and the continued prosperity of the coal industry in this period and still more in the longer term future will, to a great extent, be conditioned by the general economy of the country, and indeed, will be materially influenced by European and world economies. One of the more certain aspects likely to be operative in the immediate future is a continuance and possibly an intensification of the already keen competition between the major forms of primary energy. Therefore we must make the most strenuous endeavour to improve the competitiveness of coal.

The industry's objectives include:—Continued improvement in productivity, resulting in reduced

costs of production; attention to coal preparation to obtain the highest quality and consistency of marketable products; technical service and appropriate publicity.

CONCLUSION

The importance of carbon in the world today has been stressed and supported by information on the multifarious applications to industrial processes. The principal sources of natural carbon have been indicated, together with their estimated world reserves. It has been clearly demonstrated that the world reserves of coal far exceed those of oil and, to say the least, it would be very imprudent, if we have any regard for the long-term future, not to pursue the further development in coal technology with the utmost vigour. The USA are leading in the policy of safeguarding future energy supplies. Great Britain's indigenous resources for energy production, restricted as they are almost entirely to coal, make it imperative that there should be further advances in coal technology. This is essential to continued prosperity in the future and means of achieving this improvement must be sought now.

The utilization of the various sources of carbon over the past few years has shown a marked change both in pattern and extent throughout the world and Great Britain has been no exception. These changes are likely to continue, perhaps at reduced rates, but nevertheless the British coal industry is faced and will continue to be faced with intensive competition.

I trust that no one attending this conference wants subsidies to offset financial difficulties: nor yet fiscal protection so long as there is fair competition between the various sources of primary energy. What, then, must be our policy? In view of the intensely competitive energy markets we must improve efficiency in all the manifold operations associated with the winning, preparation, and marketing of coal and derived solid fuels. This is no academic pronouncement. It is practical common sense. We in the industry are all involved. It is you and I and the many others in the industry like us who can and must implement this policy. The coal industry must increase its efficiency, conserve its resources, maintain its capacity, and ensure the quality and consistency of its products.

Soviet Safety Device for Coal Mines

APPARATUS which makes it possible to forecast, at least six hours in advance, any sudden eruption of coal and gas, has been designed by the Moscow scientist, M. Antsyferov, and his assistants. The build-up of this phenomenon causes crackle in the coal seam; this becomes stronger as the moment of the eruption approaches. This crackling is accompanied by radiation of microcosmic waves—and the new apparatus is based on the registration of these waves. Antsyferov's "geophone," when placed in the seam, is able to detect the slightest sound oscillation in the rock. By registering these waves the "geophone" produces electric impulses, which are passed through an electronic amplifier to a tape recorder.

The operator watches the intensity of the crackles. If their number exceeds normal then an impending eruption is indicated. It is, therefore, possible to evacuate the miners from the danger spot in good time. Two "geophones" have been tested during the last few years in the coal mines of the Donetz Basin; their performance has proved to be satisfactory. The first consignment of these instruments will be manufactured shortly.

It is claimed that by using "geophones" it is possible in some cases to avert eruptions, namely, by using the readings to know when to stop working of the dangerous sections for two to four days. It appears that during that period, when the coal seam is undisturbed, the pressure is redistributed and the gas gradually leaves the strata through the cracks and pores.

Conveyor Belt Centralizer

A SIMPLE means of ensuring that a conveyor belt runs centrally on its rollers has been devised by Mr. F. Flavell, constructional steel erector at Holmewood Colliery in the East Midlands Division of the National Coal Board. It consists of a special centralizing roller designed to slew against the side-thrust of the belt if it tends to run to one side. This slewing action of the special roller forces the belt back to its central track.

The device can be adapted for use with either top or bottom belts, the principle involved being the same in each case. The centralizing roller is carried on a bracket which is balanced on a central pivot; the bracket is horizontal when the belt is running centrally, but if the belt begins to run off-centre the extra weight on one side of the roller causes the bracket to tilt.

This tilting action brings the bottom of the bracket into contact with a diagonal fishplate welded to the mounting of the device in a plane at right angles to the bracket. The bracket, when tilted, is slewed from its axis by the diagonal of the plate; this action forces the belt back on centre, and the bracket returns to the horizontal.

Slew plates are provided at both ends of the brackets to cater for tilting in either direction.

Italian Iron and Steel Output

Preliminary figures indicate that production of pig-iron, crude steel, and hot-rolled steel in Italy increased by 1.8, 7.7, and 9.3 per cent., respectively, in 1959 over the previous year. Details, with the 1958 figures in parentheses, were:—Pig-iron, 2,097,854 (2,059,760) tons; crude steel, 6,755,792 (6,271,051), tons; hot-rolled steel, 5,068,158 (4,635,247) tons.

Use of Aluminium in Deoxidation

ITS EFFECT ON SEPARATION OF DEOXIDATION PRODUCTS

Quality of a killed steel depends on the degree of purity and, therefore, on the method of deoxidation employed. A considerable number of tests have been carried out lately to obtain some clarification of the various reactions which occur with different methods of deoxidation. These are discussed by R. Rosegger in an article, of which the following is a slightly abridged translation.*

THE tests[1, 2, 3, 4] were simplified by a new method of slag isolation[5] developed during recent years. With this it is possible to determine quantitatively and qualitatively, not only the slag quantity but also the type and chemical composition of the inclusions from the melting-down period to the finished steel.

Evidence of deoxidation reactions and separation of the reaction products is given by the type of "isolated" inclusion and its chemical composition.

Oxygen in Newly Refined Melt

Numerous tests have shown that liquid steel, after a vigorous boil in the open-hearth or after a basic converter blow, contains only a negligible amount of non-metallic impurities. It can, therefore, be assumed that the oxygen contained in the newly refined melt is present predominantly in the form of dissolved ferrous oxide, which must be removed as a reaction product almost completely from the steel by means of deoxidants during pre-deoxidation in the furnace or subsequently in the ladle. It is, therefore, necessary to know the oxygen content before the melt undergoes deoxidation, this content being a measure for determining the deoxidation medium required for lowering the oxygen content of the melt to the desired equilibrium concentration at, for example, 1.600 deg. C.

The oxygen content adjusts itself towards the end of a melt according to the equilibrium distribution of oxygen between the bath and slag given, in general, by the ratio of FeO in the slag on the one hand and the oxygen content of the bath on the other. This equilibrium distribution is only valid for oxygen concentrations present in the same state in both phases and for this the expression "free oxygen" or "activity" is used. The oxygen contained in a low-carbon fully refined steel bath is assumed to be present as molecular FeO and its activity is taken as 1, while the oxygen contained in the slag is only partly present as FeO. The remainder is found in the more or less stable form of slag components such as SiO_2, CaO, and P_2O_5 and others. The chemical bond is equal to a decrease in the concentration of free oxygen in the slag respectively to a decrease in activity. The composition of the slag, for example, at the end of the blow, is, therefore, a decisive factor for the equilibrium distribution and so for the oxygen content of the bath besides the effect of temperature.

Fig. 1 shows the equilibrium distribution of oxygen content of iron melts with a pure FeO slag, and SiO_2- and lime-saturated FeO slags depending on temperature. As can be seen at 1,600 deg. C., the maximum oxygen content beneath a pure FeO slag[6, 7, 8] is reduced to about 40 per

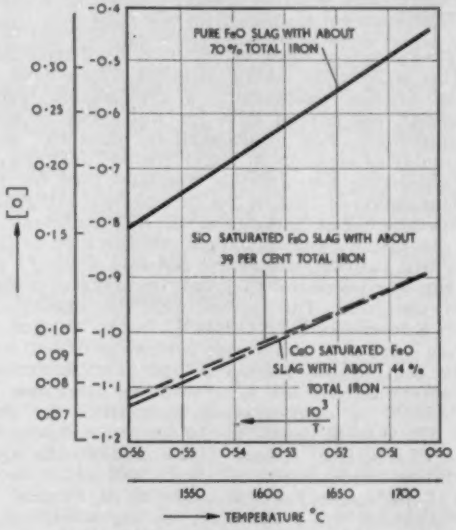

FIG. 1.—THE RELATIONSHIP BETWEEN TEMPERATURE AND OXGYEN CONTENT OF IRON MELTS UNDER A PRACTICALLY PURE IRON OXIDE SLAG AND ALSO SILICA- AND LIME-SATURATED IRON OXIDE SLAGS (AFTER SPEITH AND H. VOM ENDE).

* Radex-Rundschau, No. 6, 1958.

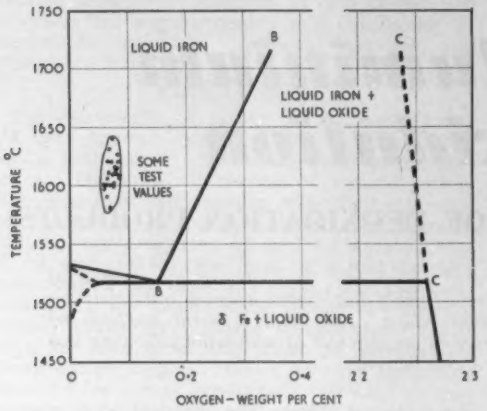

FIG. 2.—SOME TEST VALUES IN THE IRON-OXYGEN SYSTEM.

cent. due to saturation with SiO_2[9, 10] or CaO[11]. The oxygen content of a steel bath must be lower than that shown by the curve for CaO-saturated FeO slag in Fig. 1 as a basic slag, for example, usually contains from 10 to 18 per cent. iron at the end of the blow. With a normal blow the oxygen content of the bath will be 0.07 per cent. at a mean bath temperature of 1,600 deg. C., and so lower than that given by the CaO-saturated FeO slag. As shown in Fig. 2, these values lie within the solubility range of oxygen in the iron-oxygen system.

The oxygen present in a melt at the end of a refining period must be removed by deoxidation. This is done by adding elements which have, at the reaction temperature, a considerably higher affinity for oxygen than for iron. Fig. 3 gives equilibrium data of deoxidation reactions[12] of a number of elements in liquid iron at 1,600 deg. C. Considering the elements normally used for the deoxidation of steel, it can be seen, that manganese has the smallest deoxidation effect. For example, at 1,600 deg. C., and an oxygen concentration of 0.05 to 0.08 per cent. manganese contents of over 1 per cent, are necessary to lower the oxygen content of the bath. This agrees with the findings of F. Körber and W. Oelsen[13]. It can further be concluded that with a melt containing 0.05 to 0.08 per cent. oxygen and up to 1 per cent. manganese deoxidation will not occur with the formation of Fe-MnO in solid solution, even when the steel in the ladle is cooled to the teeming temperature of 1,550 deg. C. Under these conditions the equilibrium concentration of oxygen still lies at about 0.32 per cent. FeO. Deoxidation by means of manganese will only occur during solidification of the steel and will not be sufficient for refining purposes.

Effects of Carbon and Silicon

Carbon at low and silicon at slightly higher concentration of about 0.2 per cent. will serve as better deoxidants. Numerous tests have been carried out on the C-O equilibrium in liquid iron. The ideal behaviour is best represented by the equilibrium $C \times O = \text{constant}$ (0.0025 at 1,620 deg. C.) given by H. C. Vacher[14] and E. H. Hamilton[15], though the temperature and pressure dependence of the reaction must be taken into consideration[16]. It is of decisive importance for deoxidation with carbon that the equilibrium of the reaction is almost always achieved when adding carbon in the form of coke or anthracite and a carbon carrier such as spiegeleisen or ferro-manganese. It has been shown that the oxygen content of a carburized basic converter heat lies practically on the equilibrium curve. The final oxygen concentration of a low-carbon steel, containing, for example, 0.1 per cent. C., was reduced from 0.07 to 0.022 per cent. at 1,600 deg. C.

It is generally known that carbon deoxidation reaction is the only one in which the product is a gas. But a steel cannot be completely killed by means of deoxidation with carbon, even by a high concentration because the phase separation phenomena during solidification of the steel gives rise to the continuous formation of carbon monoxide. With regard to deoxidation with silicon, the equilibrium between silicon and oxygen in the presence of manganese has to be taken into account as all steels as a rule contain at least 0.2 per cent. Mn. This has been examined by F. Körber and W. Oelsen[17]. In the concentration range under consideration, *i.e.*, with more than 0.07 per cent. Si and between 0.2 and 1.0 per cent. Mn the con-

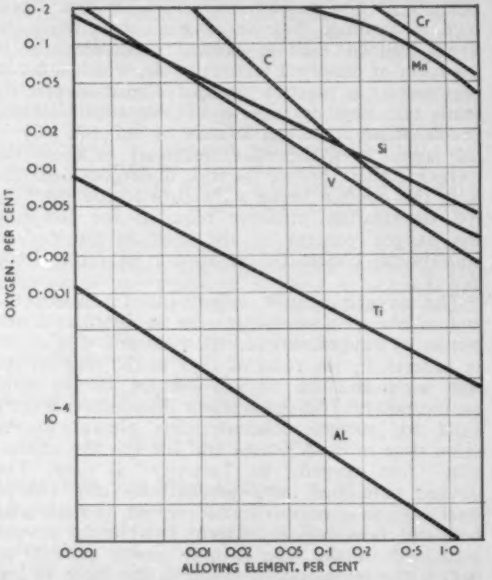

FIG. 3.—COMPARISON OF THE DEOXIDATION EFFECT OF DIFFERENT ELEMENTS IN IRON MELTS AT 1,600 DEG. C. (AFTER CHIPMAN).

ditions will only vary very little from those of pure silicon deoxidation. Körber and Oelsen have shown that with a steel containing 0.2 per cent. Si at 1,600 deg. C. the oxygen concentration is about 0.013 per cent. (0.06 per cent. FeO) and independent of the manganese content being either 0.3 or 0.5 per cent. Even a high manganese concentration will effect only a negligible decrease in the oxygen equilibrium concentration.

Aluminium and Oxygen

The equilibrium between aluminium and oxygen in liquid iron was determined from thermodynamic data in the first instance by J. Chipman[18] (Fig. 3). Experimental data given by H. Wentrup and G. Hieber[19] show, however, that the deoxidation effect of aluminium is considerably smaller. The most reliable data is that given by D. C. Hilty and W. Crafts[20], this leading to a relationship shown in Fig. 4. The equilibrium of the reaction at 1,600 deg. C. between aluminium and oxygen in liquid iron is shifted by two decimals to higher oxygen contents than those given by Chipman, and the experimental values obtained by Wentrup and Hieber lie 0.3 decimal lower than those given by Hilty and Crafts.

The presence of manganese must be considered with deoxidation by aluminium in the same way as by silicon. For example, with a fully blown basic converter heat, and the liquid steel containing about 0.01 per cent. Al an oxygen content of 0.07 per cent. can be reduced to 0.005 per cent. in the presence of about 0.5 per cent. Mn. A further decrease in the O_2-Al equilibrium concentration can be obtained when about 0.25 per cent. Si is added apart from manganese and aluminium. Hilty and Crafts examined this equilibrium and their results, shown in Fig. 5, indicate that with an aluminium content of 0.01 per cent. the equilibrium concentration of oxygen at 1,600 deg. C. falls to 0.003 per cent. when the liquid steel contains in addition 0.66 per cent. Mn and 0.27 per cent. Si.

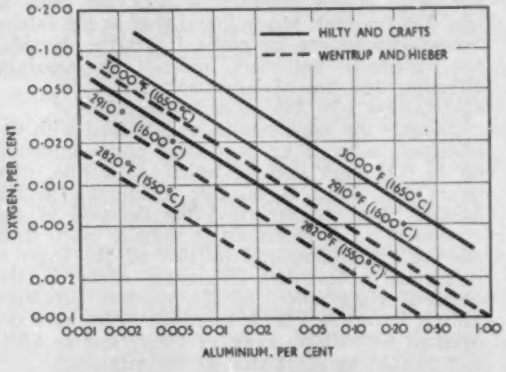

FIG. 4.—EXPERIMENTALLY DETERMINED EQUILIBRIUM CURVES FOR ALUMINIUM DEOXIDATION (AFTER HILTY AND CRAFTS).

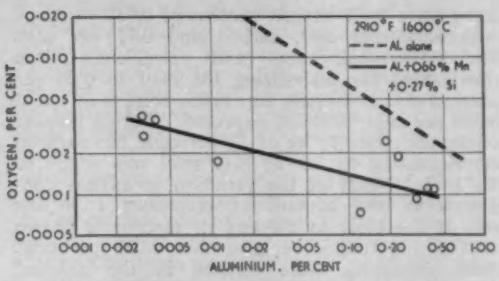

FIG. 5.—INFLUENCE OF 0.66 PER CENT. MN AND 0.27 PER CENT. SI ON THE OXYGEN SOLUBILITY OF ALUMINIUM-CONTAINING IRON AT 1,600 DEG. C. (AFTER HILTY AND CRAFTS).

If it is possible to separate within a short time the reaction products during deoxidation at these low oxygen concentrations, then higher aluminium additions should give a steel with very few inclusions, as directly after the additions of the deoxidants the maximum amount of deoxidation products will be formed. Further, due to the low equilibrium concentration of the oxygen, segregation which occurs during cooling of the melt in the ladle or during solidification of the steel can be neglected.

F. Hartmann [21] has investigated the factors which are decisive for the rise of non-metallic impurities in the bath. He showed by microscopic evaluations that considerable variations occur in the slag content of ladle steel, which can be explained by mathematical relationships deduced by him. Assuming a laminar movement, Stokes' Law was found to be suitable for determining the time necessary for slag droplets of a certain diameter to rise to the surface, if the viscosity of the steel and the specific gravity of the inclusions, and their form are known. Whether Stokes' Law has any validity for the separation of non-metallic impurities could not be confirmed on the basis of present tests. The application of mathematical relationships fails due to the fact that it is not possible to determine the viscosity of the melt and the type and size of the inclusions present therein.

Segregation of Deoxidation Products in Thomas Converter Melts

A few Thomas converter melts will now be considered to indicate the way in which separation of deoxidation products occurs in common deoxidation practice. Namely, deoxidation with silicon alone, silicon plus aluminium, and aluminium alone, and the extent to which Stokes' Law in its known form has any validity. For simplification the behaviour during precipitation deoxidation will be discussed.

Deoxidation with Silicon

Fig. 6 shows deoxidation with Si. When about 2.3 kg Si/t FeS is added to a converter for deoxidation, analysis of a sample after completion of blow-

ing gave a total oxygen content of 0.058 per cent. with 0.033 per cent. carbon and 0.11 per cent. Mn. Ferro-manganese and spiegeleisen were then added for carburizing the melt to 0.06 per cent. so that at tapping an oxygen content of about 0.040 per cent. could be expected. During tapping of the converter 75 kg of 75 per cent. ferro-silicon corresponding to 2.3 kg Si/t steel was added to the ladle. Study of the variation in oxygen concentration and content of inclusions from the end of the blow to the end of tapping is shown in Fig. 6. It can be seen that 0.087 per cent. oxide inclusions were isolated in the unkilled converter sample, which corresponds to 0.031 per cent. O_2. The difference with regard to the total oxygen content is due to those oxide inclusions which could not be detected by isolation and corresponds to 0.122 per cent., if the loss is calculated as MnO and FeO. This gives total inclusions of 0.209 per cent. in the converter sample. The very small solubility of oxygen in solid iron can be neglected in this calculation.

A ladle analysis of the upper part of the steel melt taken directly after the deoxidation reaction finished, showed that the deoxidized steel contained at that moment still 0.035 per cent. total oxygen of which 0.013 per cent. could be isolated in the form of 0.028 per cent. inclusions. The total oxygen content and the amount of inclusions increase at first and then decrease again to the value for the upper part of the steel melt when casting is finished. At tapping the steel will have a mean oxygen content of 0.038 per

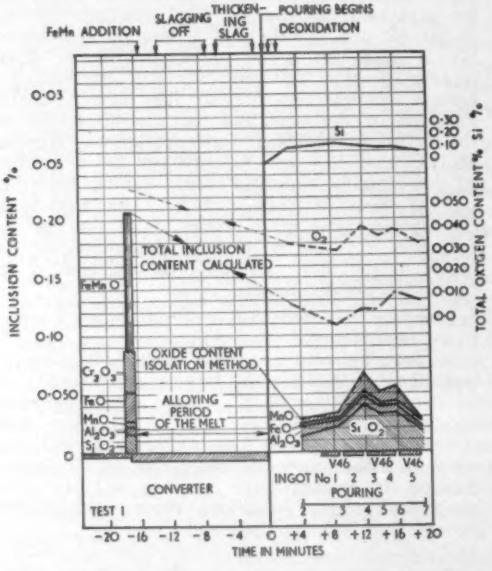

FIG. 6.—COURSE OF DEOXIDATION WHEN DEOXIDIZING WITH SILICON ALONE (AFTER PLÖCKINGER AND ROSEGGER).

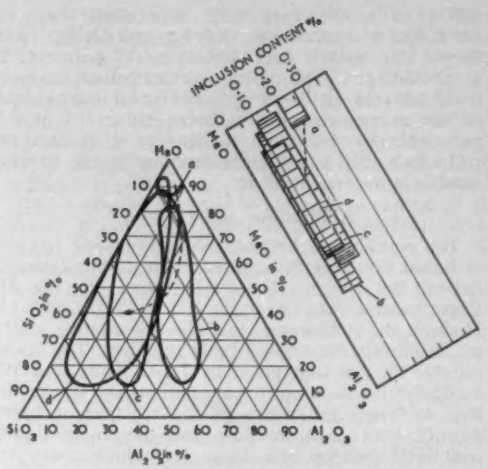

FIG. 7.—CHANGE IN CHEMICAL COMPOSITION OF OXIDE INCLUSIONS FROM CONVERTER TO INGOT FOR STEEL OF 0.02 TO 0.10 PER CENT. C. WHEN DEOXIDIZED WITH SILICON ALONE OR SILICON AND AN ADDITION OF UP TO 0.35 KG. AL/T OF STEEL.

(*a*) Converter steel after completion of blow (calculated).
(*b*) Ladle test after deoxidation (calculated).
(*c*) Teeming test (calculated).
(*d*) Billet test (calculated).

cent. and 0.048 per cent. "isolated" inclusions in the casting samples. The total content of inclusions in the casting samples, that is, including those which cannot be isolated is, on average, 0.120 per cent. The initial total content of inclusions has, therefore, been decreased by 58 per cent. There were large differences in the amounts of inclusions contained in the individual casting samples, but this may be explained by an unstable condition of the melt when deoxidation is carried out in the ladle.

When comparing these results with theoretical values of final oxygen contents of about 0.010 per cent. in the presence of 0.13 per cent. Si and 0.39 per cent. Mn in liquid steel at the casting temperature, it can be realized that the deoxidation products are very difficult to separate, although they are of large, spherical form.

Deoxidation with Silicon and Aluminium

Roughly the same results are obtained with deoxidation using 2 kg Si/t steel plus aluminium up to 0.35 kg/t steel of which, as a rule, only traces are found as metallic aluminium in the finished steel. Apart from the decrease in the content of oxide inclusions in samples taken from the converter compared to that of the ingot it is further noted that differences occur in the chemical composition of the reaction products. This is shown in Fig. 7, in which melts were deoxidized with silicon alone or silicon and an addition of 0.35 kg Al/t steel at the maximum.

Range *a* gives the chemical composition of the inclusions found in the unkilled converter sample including those which could not be isolated and

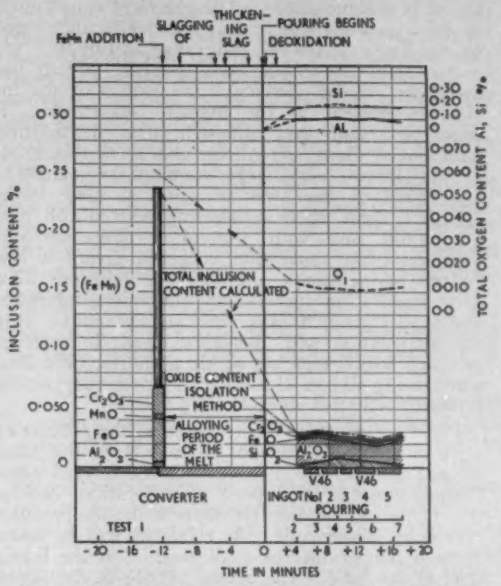

FIG. 8.—COURSE OF DEOXIDATION WHEN DEOXIDIZING WITH SILICON AND ALUMINIUM TOGETHER IN THE RATIO 1:1 (AFTER PLÖCKINGER AND ROSEGGER).

assumed to be MnO-FeO. The total number of inclusions in the converter sample has, therefore, a mean chemical composition consisting of 90 per cent. metal oxides (FeO, MnO, Cr_2O_3) and 10 per cent. non-metallic oxides (SiO_2 and Al_2O_3).

Range *b* gives the chemical composition of the inclusions formed after adding deoxidants to the ladle. It is found that the composition of the oxide impurities will only vary slightly in the direction of the system SiO_2-Al_2O_3 during precipitation deoxidation with silicon alone. A more pronounced decrease in metal oxide content will occur if aluminium is used in addition which is shown also by a more pronounced change in the composition of the inclusions towards the SiO_2-Al_2O_3 system.

Range *c* shows the chemical composition of the oxide inclusions in the ladle during casting. This applies especially to melts which were deoxidized with aluminium additions. The variation is, therefore, due to the segregation of alumina-rich reaction products which has led, in general, to a slightly lower inclusion content.

The inclusions found in the ingot shown in range *d*, correspond mainly to those in the casting samples, but are in some cases higher in SiO_2, especially when the melt was deoxidized with silicon alone. As seen from Fig. 7 separation of such deoxidation products is very poor. As expected, an increase in aluminium additions up to between 2.0 and 2.5 kg/t steel keeping silicon at 2.0 and 2.3 kg/t steel, will lead to complete destruction of the FeO so that the total content of inclusions can be ascertained by the isolation method (Fig. 8).

The melt in the converter after the blow had a total oxygen content of 0.062 per cent. and 0.071 per cent. oxides could be isolated. When adding ferro-manganese or spiegeleisen to the converter a carbon content of about 0.05 per cent. was obtained. Ferro-silicon and aluminium were added together to the ladle during tapping. Taking a sample from the upper part of the ladle at the end of precipitation deoxidation it is found that the steel will contain only 0.014 per cent. total oxygen, which corresponds to a total quantity of inclusions of 0.027 per cent. The number of inclusions and total oxygen content will vary only very little till tapping is completed.

Deoxidation carried out with silicon and aluminium at the ratio 1:1 will result in very few inclusions in the steel and a considerable change in the chemical constitution of the oxide inclusions. Fig. 9 shows the variation in chemical composition directly after adding the deoxidants, which moves from range *a* towards the alumina corner of the system SiO_2-Al_2O_3-MeO to range *b*. The mean chemical composition of those in the casting samples taken within *c* will not be changed. It is noteworthy that the inclusions found in casting samples within *c* contain only a few per cent. of FeO and Cr_2O_3, no MnO, but 20 to 30 per cent. SiO_2 and 65 to 75 per cent. Al_2O_3. Ingot samples, range *d*, have oxide inclusions of practically the same composition as those in casting samples. The inclusions, however, contain less alumina, probably due to the alumina-rich silicate which rises to the surface with the ingot scum.

As can be seen from Fig. 9, there is a remarkably

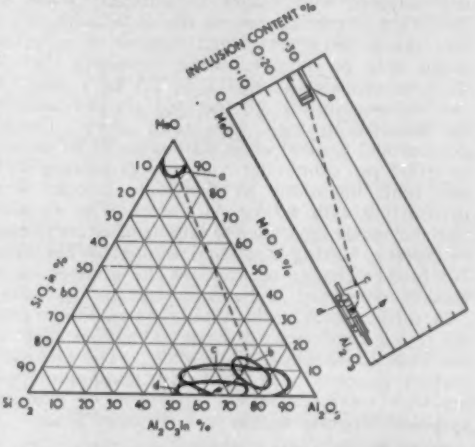

FIG. 9.—CHANGE IN CHEMICAL COMPOSITION OF OXIDE INCLUSIONS FROM CONVERTER TO INGOT FOR STEEL OF 0.02 TO 0.10 PER CENT. C. WHEN DEOXIDIZED WITH SILICON AND ALUMINIUM IN THE RATIO 1:1.

(*a*) Converter test after completion of blow (calculated).
(*b*) Ladle test after deoxidation (isolation method).
(*c*) Teeming test (isolation method).
(*d*) Billet test (isolation method).

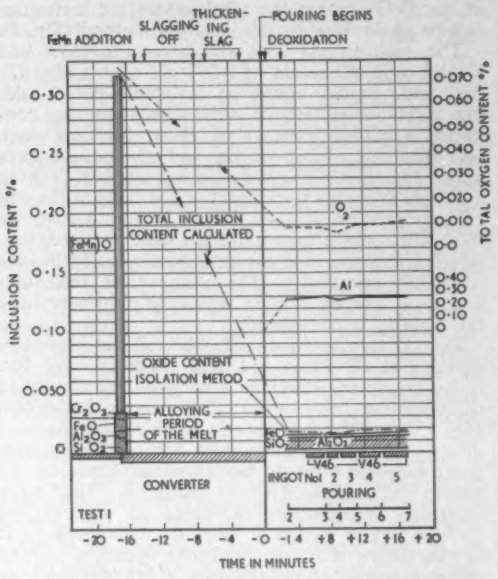

FIG. 10.—COURSE OF DEOXIDATION WHEN DEOXIDIZING WITH ALUMINIUM ALONE (AFTER PLÖCKINGER AND ROSEGGER).

steady decrease to a very low inclusion content during casting till the ingot has solidified, although, according to Stokes' Law, this is contrary to what would be expected with the small inclusions that are obtained with silicon deoxidation. When deoxidation is carried out in the ladle with silicon and aluminium a very small number of inclusions could only be obtained when increasing the aluminium additions from 0.3 to 2.5 kg/t steel. As can be seen in Fig. 10 this can also be achieved by deoxidation with aluminium alone. Oxygen content and content of inclusions could be reduced to 0.009 per cent. total oxygen representing 0.015 per cent. inclusions in the ladle sample when deoxidizing with 4.5 kg Al/t steel. The alumina-rich inclusions separate one minute after completion of tapping, leaving a residual amount as described. No further change occurred in the number of inclusions contained in the ladle steel during casting.

A further increase in aluminium additions from 4.5 to 6.5 kg/t steel will have no marked effect on the inclusion content of the steel. The inclusions present in melts deoxidized with aluminium only, are very small, colourless, spherical, or granular, and will separate within a very short time.

Deoxidation with Aluminium Only.—As is shown in Fig. 11, deoxidation carried out with aluminium alone results in a marked change in the chemical composition of the oxide inclusions from converter to the ladle. Due to the large affinity of aluminium for oxygen, practically pure alumina is obtained so that even manganese cannot be found in the inclusions. The chemical constitution of the inclusions will remain practically unchanged in the range *c* (ladle) and range *d* (ingot).

Air oxidation of the steel pouring stream has no effect on the chemical composition of the inclusions present in the ingot. Nevertheless, it must be stated that although after deoxidation with silicon alone and silicon plus a small amount of aluminium, very large contents of inclusions are found in the steel in spite of their large, spherical form when deoxidizing with silicon plus aluminium, and with aluminium alone an unexpected good separation occurred giving a low content of inclusions, although the inclusions were very small. An increase in aluminium additions above that given usually or using aluminium only for deoxidation will, therefore, result in reaction products which separate within a shorter time than when using silicon alone which is contrary to the hitherto accepted view.

Fig. 12 gives more information on the process of separation in low-carbon melts. Here the total oxygen content is compared with the oxygen equilibrium concentration present in solution, besides that of the deoxidation elements at the temperature prevailing in the ladle. As reference can be taken a mean temperature of 1,550 deg. C. of the liquid steel in the ladle. The excess oxygen in the liquid steel in the ladle at 1,550 deg. C. is present in the form of deoxidation products and can, therefore, at the same time be a measure for the degree of purity of the liquid steel. For example, deoxidizing a steel containing 0.17 per cent. Si plus 0.01 per cent. met. aluminium with silicon and with or without small additions of aluminium results in

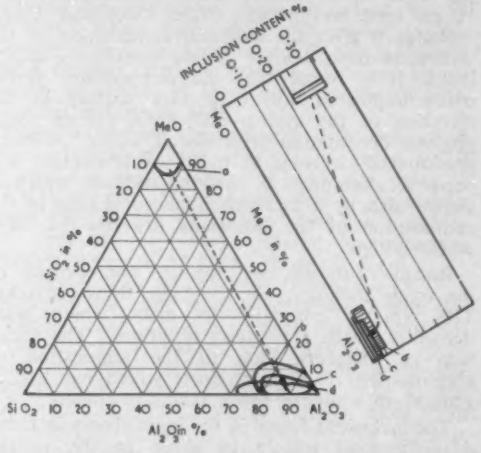

FIG. 11.—CHANGE IN CHEMICAL COMPOSITION OF OXIDE INCLUSIONS FROM CONVERTER TO INGOT FOR STEEL OF 0.02 TO 0.10 PER CENT. C. WHEN DEOXIDIZED WITH ALUMINIUM ALONE (4-6.5 KG AL/T OF STEEL).

(*a*) Converter test after completion of blow (calculated).
(*b*) Ladle test after deoxidation (isolation method).
(*c*) Teeming test (isolation method).
(*d*) Billet test (isolation method).

0.032 per cent. more oxygen in the steel than that corresponding to equilibrium. The segregation of these deoxidation products is very difficult after ferro-manganese addition has been made to the converter referred to the initial 0.040 to 0.050 per cent. O_2 before deoxidation.

When deoxidizing with silicon plus aluminium only 0.012 per cent. O_2 in excess will remain in the steel than that corresponding to equilibrium, if the melt contains 0.19 per cent. Si and 0.12 per cent. met. Al. Separation is now only two thirds to four fifths that of the initial oxygen directly after adding the deoxidants. Similar conditions prevail when deoxidizing with only aluminium where about 0.0090 per cent. oxygen in excess remains in the steel than that corresponding to equilibrium, if the melt contains traces of up to 0.02 per cent. Si and 0.30 per cent. met. Al.

It is interesting to know, in addition to the content of inclusions, in various ladle deoxidized melts, the process of separation of the reaction products in the ingot mould, and the distribution of the oxide inclusions in the ingot. It is shown that in the ingot, separation occurs preferably by deoxidation products rich in alumina. The effect of air oxidization during casting must be taken into account when evaluating the results. The extent of the effect in the individual methods of deoxidation was not determined, as all melts were top-poured under the same conditions.

Considering the different separation behaviour of oxide inclusions in liquid steel in the ingot mould, phase separation phenomena can be expected to occur in the ingot. In fact, differences occur in the number of inclusions of the isolated residues in the top end, centre, and bottom end of the ingot. Deoxidation with silicon alone or with small additions of aluminium to a max. 0.4 kg/t gave results which could be expected. Namely, a small number of inclusions in the top end and centre of the ingot, after making a sufficient discard from the top. The bottom end of the ingot contained, as a rule, twice the number of inclusions. The large scatter observed with this type of deoxidation shows also how much the final result depends on unknown factors. The lower limit of the range of scatter corresponds mainly to those melts of high carbon and manganese content and also those which received aluminium additions of up to 0.3 kg/t steel besides silicon.

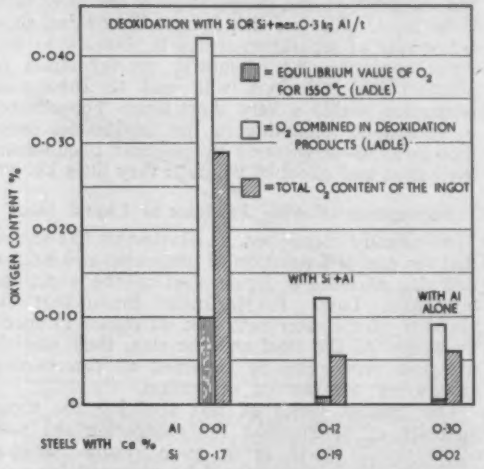

FIG. 12.—COMPARISON OF THE TOTAL OXYGEN CONTENT WITH THE EQUILIBRIUM CONCENTRATION OF OXYGEN.

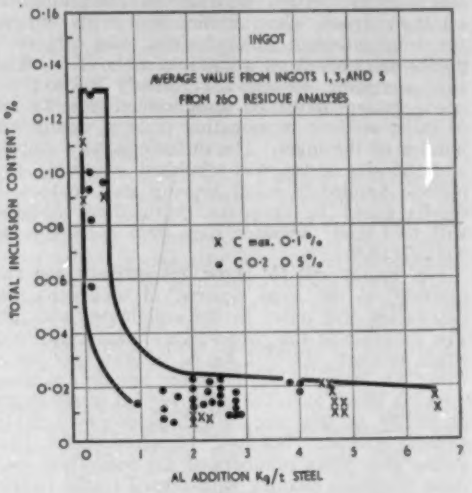

FIG. 13 (*a*).

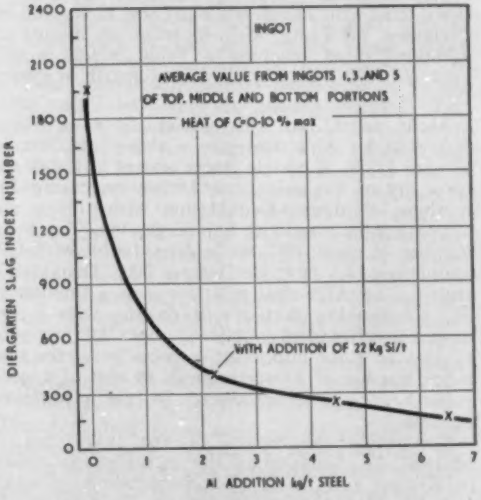

FIG. 13 (*b*).

FIG. 13 (*a*) AND (*b*).—RELATION BETWEEN TOTAL INCLUSION CONTENT AND THE DIERGARTEN SLAG INDEX NUMBER AND THE AMOUNT OF ALUMINIUM ADDED.

Deoxidation with silicon plus aluminium at a ratio of 1:1 gives a surprisingly uniform result for a number of melts. The quantity of inclusions is less and practically the same in all parts of the ingot. The same result is obtained when deoxidizing with aluminium alone, 2 to 6.5 kg/t steel. The average alumina content of the isolated inclusions showed no marked difference in the top end, centre, or bottom end of the ingot with the increasing aluminium addition.

Having established the formation of oxide inclusions under certain deoxidation conditions, the question arises what relationship exists between the total number of inclusions, and degree of purity determined on a suitable scale. An evaluation according to H. Diergarten's method was used, taking hardened longitudinal micrographs of billet sections representing the top, centre, and bottom of the ingot. The inclusions were counted and the slag index was tabulated according to a method applied to roller bearing steel so that the results could be compared with those obtained with tool steel. Sulphide slags were not taken into consideration.

Fig. 13 (*a*) and (*b*) show, respectively, the relationship of the total content of inclusions, and Diergarten slag index to the aluminium additions. The decrease in the percentage of inclusions takes effect at about 0.8 to 1 kg Al addition per ton of steel. An increase in aluminium addition to about 6.5 kg/t shows a visible improvement in the degree of purity of this steel which is contrary to the hitherto accepted opinion. In addition the Diergarten slag index numbers of the individual melts show complete analogy with regard to the isolated and partly calculated oxide inclusion contents. A high slag index number is obtained with melts deoxidized with silicon while the slag index number decreases markedly with increase in aluminium additions often reaching a value which is only expected with a good quality open-hearth or electric furnace steel.

Melts deoxidized with silicon alone or silicon plus 0.45 kg Al/t steel give a slag index number around 2,000. A visible improvement in the degree of purity of the steel occurs when increasing aluminium additions. Deoxidation with silicon and aluminium in a ratio of 1:1 results in a slag index number of about 400, while deoxidation with only aluminium (4.5 kg/t steel) gives 200. Deoxidation with 6.5 kg Al/t steel will give a slag number of 57. Considering that one is dealing with a soft basic converter steel containing about 0.05 per cent. C, this is quite important, especially as the slag index number of 57 corresponds to that of a good roller-bearing steel produced in the electric-arc furnace.

Comparing the results of the two types of analysis, *i.e.*, isolation of the inclusions according to Klinger and Koch, and enumeration of oxide inclusions according to Diergarten, good agreement was found and a good and safe evaluation of the inclusions with the slag isolation method was, therefore, confirmed at the same time.

It was further established that both determinations, *i.e.*, isolation of oxide inclusions and enumeration according to Diergarten, could be carried out with the same billet sections. Determination of the slag index numbers was carried out in such a way that the total number was calculated on the basis of nine samples per melt from the top, centre, and bottom of the ingot. It was found that with melts deoxidized with aluminium alone and those with silicon plus aluminium at a ratio of 1:1, no marked difference exists in the slag index of samples taken from the top, centre, and bottom of the ingot, and, therefore, good agreement exists with the isolated oxide quantities in the individual sections of the ingot obtained from melts deoxidized in this way. Melts deoxidized with silicon alone give a higher slag index number in the bottom of the ingot compared with those in the centre and top, again showing good agreement. In this connection it must be pointed out that while large additions of aluminium for deoxidation purposes, will increase the purity of the steel, its mechanical properties are adversely affected if an optimum amount of aluminium is exceeded.

Tests have shown that under favourable deoxidation and separation conditions even with a Thomas steel, inclusion contents of the order as those of good open-hearth or electric-furnace steel are obtained. It can also be seen that the result is practically independent of the type of manufacture of the steel so that the initial oxygen content of the melt before deoxidation is of minor importance. The initial oxygen content will influence in the first instance, only the quantity of deoxidants which are necesary for deoxidation. Parallel tests carried out with open-hearth and electric-furnace heats gave practically the same results with regard to inclusion content when deoxidizing with aluminium.

The rate of separation of deoxidation products is shown, therefore, to be mainly dependent on the composition and temperature of the steel bath. Even liquid silicates, rich in metallic oxides, show a low rate of separation which is contrary to previous concepts, As is shown, the formation of alumina-rich inclusions will lead to substantial separation within a very short time. The number of inclusions remaining in the liquid steel must, therefore, be determined by physical phenomena, the extent and effect of which is very little known.

Segregation of Slag Particles in Liquid Steel

As already mentioned, F. Hartmann has shown that the rate of separation of suspended and emulsified slag particles in liquid steel can be explained by Stokes' Law. F. Hartmann found that the viscosity of the steel bath, the difference in specific weight of the steel and the slag, their particle size and form, can be regarded as determining factors for the rate of separation.

The present series of test applying the three methods of deoxidation for comparing the rate of separation have given good results because separation phenomena could be observed by continuous sampling of the ladle steel.

Deoxidation with silicon results in the formation of glassy, drop-like silicates, their particle size being up to 1 mm. Separation of these silicates is poor. Examination under the microscope shows minute reaction products clinging to the large inclusions being distributed uniformly around them. Deoxidation with equal amounts of silicon and aluminium (about 2 kg/t steel each) produces inclusions which consist of glassy alumina-silicates of about 0.005 mm dia. and particles of up to 0.02 mm are very seldom observed. Separation is good. This type of reaction product is not subjected to an increase in size by the adherence of minute reaction products.

Alumina-rich inclusions of spherical form of less than 0.005 mm dia. are found when deoxidizing with aluminium alone. Separation is good and minute reaction products are not observed adhering to them, but it is found that the inclusions will combine to form larger groups. It has been observed that inclusions which contain more than 70 per cent. Al_2O_3 and which should be solid at the liquid steel temperature (1,550 to 1,600 deg. C.) are spherical and have obviously been formed via a liquid phase. This may be explained by an increase in the steel temperature locally due to the strong exothermic reaction between aluminium and metal oxides. In any case extensive formation of crystalline corundum previously thought to occur can now be discounted.

Stokes' Law and Deoxidation Products

According to previous concepts with regard to the separation of deoxidation products in liquid steel and in agreement with Stokes' Law, it could be assumed that with uniform steel composition and temperature the relatively large liquid silicates obtained with silicon deoxidation, precipitate earlier than the alumina-rich, relatively small deoxidation products obtained when adding large amounts of aluminium or aluminium alone.

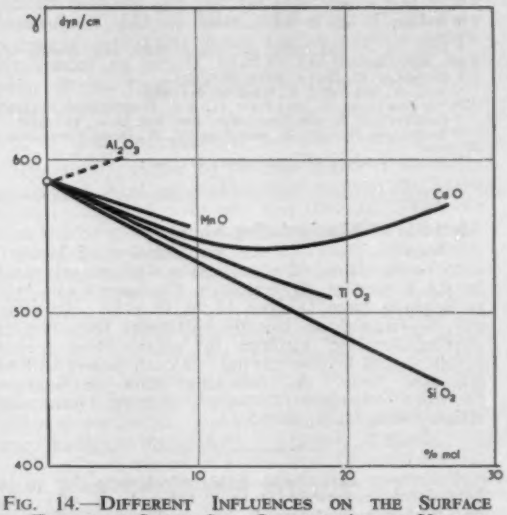

FIG. 14.—DIFFERENT INFLUENCES ON THE SURFACE TENSION OF LIQUID IRON OXIDE OF ADDING VARIOUS OXIDES SUCH AS SiO_2, CaO, MnO, AND Al_2O_3 (AFTER F. KOZAKEVITCH).

It is surprising that the opposite was observed with all deoxidation tests. The glassy, easily liquefied large silicates are more difficult to separate than the alumina-rich small inclusions.

The exceptionally large variation in the rate of separation of different types of deoxidation products in liquid steel indicates that particle size, form, and viscosity according to Stokes' Law, and the relative small variation in specific gravity of the slag particles, are not the only determining factors. Rate of separation must also depend on other forces which exist between oxide particles and the liquid steel such as surface tension and wettability.

Surface Tension

The surface tension of a liquid or solid is not, in general, a valid material constant, as it depends on the material adjacent to it, temperature, and dissolved impurities. The surface tension of cast iron [22] is especially affected by the presence of sulphur as is generally known. The same applies to phosphorus which greatly affects the surface tension of cast iron, while silicon has only little effect. It is of far greater importance for the separation of reaction products that silicate slags (for example, those which are formed during the first stage of the Thomas converter blow) have a very small surface tension[23]. The surface tension of the pig-iron is also small and a small boundary tension exists between the two phases which is equivalent to good wettability of both phases encouraging the formation of an emulsion and impeding separation of silicate slags. It is further known that the silicates contain free ions, such as SiO_4 ions, at the phase boundaries which will lead to an accumulation of FeO and prevent the silicate from moving freely in the metal bath due to valency forces[24]. The accumulation could actually be observed with the reaction products formed when deoxidizing with silicon. It can therefore be assumed that a continuous reaction of the silicates occurs due to free ions till the steel is solidified and that, at the same time, due to the free energy of valency of this type of inclusion the freedom of motion of these reaction products and their consequent rise to the surface is impaired. F. Kozakevitch has found experimentally that slags which, under normal conditions, do not wet the liquid iron, will do so if the boundary tension is being decreased by means of a chemical reaction, as is the case, for example, with $CaO\text{-}Al_2O_3\text{-}SiO_2$ slags.

The foregoing is in good agreement with the exceptionally poor degree of separation of the reaction products when deoxidizing with silicon. These factors have not been considered by F. Hartmann and he has not taken these into account when applying Stokes' Law. Even minute reaction products obtained when deoxidizing with alu-

minium alone were found to behave quite differently with regard to their separation tendencies as would have been expected according to F. Hartmann. These will rise to the surface within a very short time compared with the larger silicates, and the behaviour can be explained by the extraordinary low wettability of alumina inclusions by liquid steel. It can be assumed that in this case no free ions or valency forces are present which will impair the movement of these reaction products in the liquid steel. G. Becker, G. F. Harders, and H. Kornfield[25] have shown that molten steel droplets will not wet sintered alumina and the cooled-down steel droplets can be removed without difficulty from the underside of sintered corundum even if a temperature of 1,700 deg. C. has previously been maintained for some hours. This test shows that the boundary tension between the two phases is very high and wettability, therefore, very small which explains the fact that deoxidation products consisting of alumina or alumina-rich phases have a good tendency to separate.

The results agree well with those obtained with aluminium deoxidation where the reaction products separated within a short time. Work carried out by Kozakevitch[26] gives more information on the behaviour of differently composed deoxidation products and their rate of separation. As can be seen from Fig. 14, the surface tension of liquid FeO is being influencd to a different degree by adding various oxides such as SiO_2, CaO, MnO, and Al_2O_3. Alumina increases the surface tension of the FeO, while silica and TiO_2 and MnO decrease it to an equal degree. CaO in small amounts decreases the surface tension, but increases it at higher concentrations.

If this is applied to inclusions obtained with the above methods of deoxidation it can be seen that the surface tension of these products is decreased to the same extent as SiO_2 and MnO are increased, and, on the other hand, is increased correspondingly the higher the Al_2O_3 concentration in the inclusions. It is, therefore, obvious that a "minimum" aluminium addition is decisive for the formation of products with a high-surface tension and for a good and rapid separation of the products due to low wettability by the liquid steel. A sufficiently high temperature of the liquid steel before doxidation is necessary.

Tests carried out on the wettability of quartz, sillimanite, and sintered alumina by liquid steel have shown that a definite relationship exists between surface tension, wettability, and segregation of the slag particles in liquid steel. With regard to separation, the derivations of Stokes' Law have been changed considerably due to the foregoing described physical factors. Further tests, will therefore, have the aim to determine the actual surface tension of differently composed deoxidation products and to consider its effect on Stokes' Law when determining theoretically the upward velocity of slag particles in the steel bath.

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Metal Statistics, 1960

This is the 53rd edition of "Metal Statistics," published by the American Metal Market. It is virtually a key to locating a broad variety of price, production, and consumption information on metals and related economic data. In a minimum of space it presents useful historical and current data of recognized value to metal industry executives, purchasing agents, metal sales experts, market research and special survey staffs, economists, investment analysts, and others. In its 400 pages are given statistics covering all of the important metals from aluminium and beryllium to vanadium and zinc. It contains an index and a 130-page Buyers' and Sellers' Guide. Among the new tables added this year are four on plastics, one of which is a comparison of the cost of plastics with other metals. Copies of the 1960 edition, edited by Norbert J. Langer, may be obtained for $3.75 from the American Metal Market, 18, Cliff Street, New York 38, N.Y.

Methods of Manipulating Metals

"Modern Trends in the Manipulation of Metals" is to be the theme of a national conference organized by the Institution of Production Engineers to be held at Brighton from October 12 to 14 next. Attention will be focused on recently significant technological developments in methods of manipulating metals which do not involve cutting. Sixteen papers will be presented under the following main headings:—Extrusion techniques; precision forging; form and spline rolling; sheet forming.

THE FIRST ELECTRICAL FAIR, which was due to be held from September 23 to October 1, at Alexandra Palace, has been deferred. The majority of exhibitors having indicated that they would prefer a site in central London for the exhibtion. The organizers hope to make a further announcement shortly.

Mine Fatalities at Record Low Level

REPORT ON WEST MIDLAND AND SOUTHERN DIVISION

NUMBER of persons killed in accidents at collieries in the West Midland and Southern Division of the Mines Inspectorate in 1959 was the lowest on record. Twenty-nine persons were killed and 190 seriously injured, compared with 42 and 187, respectively, in 1958. Recording these figures (Table 1) in his annual report, Mr. F. S. Pollard, HM Divisional Inspector of Mines, states that 13 persons were killed and 83 seriously injured by falls of ground during last year, against 23 and 52 in the previous year, representing 43.8 per cent. of all killed and seriously injured.

Many of the accidents were concerned with falls of roof at the face; nine persons were killed and 25 seriously injured in these circumstances. These figures are identical with those for 1958.

Seven persons were killed and 42 seriously injured in underground haulage and transport accidents, compared with five and 54, respectively, in 1958, representing 27 per cent. of all killed and seriously injured. Five of the fatal accidents and 23 of the accidents involving serious injury were associated with mechanical haulages.

A number of the non-fatal accidents during the year under review involved men being trapped between colliding tubs or mine cars. The need for positive means of control of vehicles on gravity haulages is too often overlooked, states the Divisional Inspector. One fatal accident and 11 non-fatal accidents were associated with conveyors and gate-end loaders. Misunderstanding between people working on conveyors can often result in serious injuries. In the interest of safety, every conveyor should be fitted with a good signalling system incorporating visual and/or audible signals throughout its length, so that all persons at any point on the conveyor will be warned when it is about to start.

No Improvement in Four Years

The total number of persons killed or seriously injured in haulage accidents is exactly the same as last year and only one less than for 1957. In fact, there has been practically no improvement over the last four years. This, the Divisional Inspector comments, is difficult to understand when one considers the large number of haulage and transport reconstruction schemes that have come into operation during this time which undoubtedly have provided greater working clearances and removed some of the causes of previous accidents. Closer supervision by officials, greater care on the part of haulage personnel, and continued elimination of poor haulages installation is urgently needed.

Three persons were killed and 24 seriously injured from miscellaneous causes, compared with five and 28, respectively, in 1958, representing 12.3 per cent. of all killed and seriously injured. One fatal and seven non-fatal accidents occurred with machinery. The fatality occurred on an orthodox mechanized longwall face working a 5-ft. 6-in. seam on a gradient of 1 in 3.6. A man, who was walking on a stationary conveyor chain and passing a working coal-cutting machine slipped and his leg was caught by the unguarded cutter picks. Officials, it is stated, should ensure that guards are not only provided but are used.

There were also two cases of serious injury by the haulage ropes of coal-cutting machines mounted on armoured conveyors. In both cases the ropes were insecurely attached to the conveyor. Improvisation, it is pointed out, is dangerous when such powerful machines are being used and every effort should be made to eliminate the practice.

Two persons were killed, 21 seriously injured, and four received minor injuries in surface accidents, compared with five, 13, and one, respectively, in the previous year.

At the end of last year, there were 62 mines operated by the National Coal Board and 55 working under licences issued by the board in the West Midland and Southern Division. Recording a fall in manpower of some 6,694 persons at mines operated by the NCB, the Divisional Inspector of Mines says that in certain areas many men left the mines towards the end of the year, resulting in a shortage in manpower, particularly at mines adjacent to highly industrialized areas. Total

TABLE 1.—*Persons Killed or Seriously Injured at Coal Mines in West Midlands and Southern Divisions during 1959, compared with the Average for 1956-58.*

Classification of accident.	Killed.		Seriously injured.		Reported by reason of cause only.
	1959.	Average 1956-58.	1959.	Average 1956-58.	1959.
Falls of roof at working face	12	16.3	42	31.7	—
Falls of face or side at working face	—	2.0	32	26.7	—
Other causes	15	14.3	95	92.3	37
Total: Underground	27	32.6	169	150.7	37
Surface	2	3.4	21	18.7	4
Total underground and surface	29	36.0	190	169.4	41

manpower at the end of the year was 49,688 and 6,610 in the NCB's West Midlands and South-Eastern divisions, respectively. The recruitment of boys up to the age 18 years is causing concern; 1,041 boys were recruited during the year, which is over 33 per cent. less than in 1958.

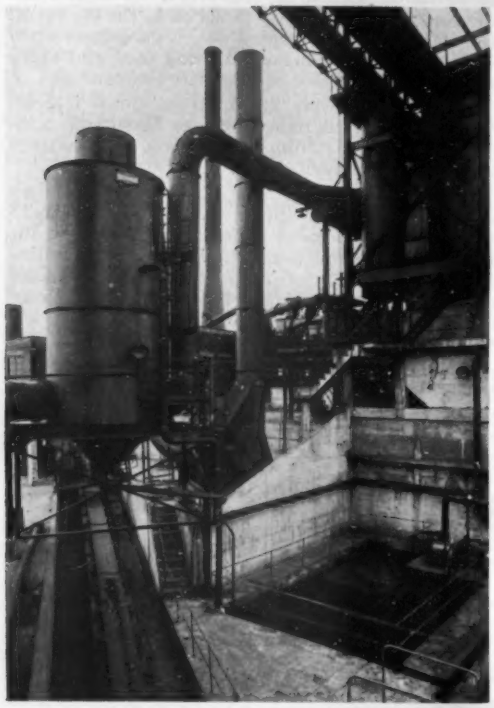
The general recession in trade was reflected in the tonnage produced, which showed a decrease of nearly 1,000,000 tons compared with the previous year. The total saleable output of coal from all mines, including licensed mines, was 15,947,400 tons from the NCB's West Midlands Division and 1,613,300 tons from its South-Eastern Division. Output per manshift increased during the year to 87.78 cwt. at the face and 26.74 cwt. overall in the West Midlands Division and 71.08 cwt. at the face and 21.45 cwt. overall in the South-Eastern Division.

Smokeless Fuel Producers

REMOVE A SMOKE NUISANCE

SMOKELESS fuel manufacturers have for a long time been receiving complaints from local authorities and residents that their plants are creating too much smoke and dust. A Derbyshire parish council recently complained that the smoke from one plant "had to be seen to be believed and often looked like an atom bomb cloud."

The problem has been solved by the National Carbonizing Company, Limited, which has installed a specially designed smoke- and dust-extraction plant at its Edwinstowe works. This plant, known as the Holmes-Schneible multi-wash system, was designed and installed by W. C. Holmes & Company, Limited, to the order of the main contractor, Newton, Chambers & Company, Limited. The dust plant was installed following extensions to the low-temperature carbonization plant to double production of "Rexco" smokeless fuel. The plant now comprises 14 retorts, each capable of holding 34 tons of coal.



THE NEW SMOKE AND DUST EXTRACTION PLANT AT THE EDWINSTOWE (NOTTS) SMOKELESS FUEL PLANT OF THE NATIONAL CARBONIZING COMPANY, LIMITED.

The base of each retort is enclosed by an exhaust hood which prevents the escape of dust and raw gas when the retorts are discharged. A considerable amount of steam from the quenching water is exhausted at the same time. Two branch connections from each exhaust hood connect with the main duct which runs along the complete length of the retort installation. As there are only two branches out of the total of 28 in operation at any one time, special dampers were made to ensure that the branches are virtually air tight in order that the maximum percentage of the total gas volume is exhausted from the hood in operation.

The Holmes-Schneible collector is a size 124 type "JC" and contains two and a half impingement or washing stages. It is positioned midway between two banks of seven retorts and for this reason has two inlets. The fan is installed on the clean gas side of the collector and handles 34,000 cu. ft./min. against the system resistance of 8 in. w.g. It absorbs 56.6 h.p. from the 60-h.p. driving motor. The washing medium is recirculated from a concrete effluent tank installed by Newton, Chambers.

Combustion Engineers' Conference

"Getting the Best Out of Coal," embracing boiler plant and industrial furnaces and kilns, is to be the theme of the Combustion Engineering Association's conference to be held at Harrogate (Yorks) on November 8 and 9. Papers will be given on:— "Choosing the Right Coal," "Operating and Maintaining the Plant," "Choosing New Plant or Extensions to Existing Plant," and "New Developments."

Sidney Gilchrist Thomas

is

Honoured in His Native Land

NO longer is the world pioneer of basic steelmaking, Sidney Gilchrist Thomas, without honour in his native land. On Wednesday of last week a memorial to his name was unveiled by Mr. G. H. Latham, chairman of the Whitehead Iron & Steel Company, Limited, and president of the Newport and District Metallurgical Society. The ceremony was attended by a large gathering of people from the steel and allied industries.

The visible memorial has been erected on the site of the former Blaenavon Iron & Steel Company and takes the form of an obelisk in polished red granite bearing a life-like bronze head of Sidney Gilchrist Thomas in heavy relief and a bronze panel recording that successful experiments were carried out by him with the assistance of his cousin, Percy Carlisle Gilchrist.

In addition, there is to be established a Sidney Gilchrist Thomas Trust Fund, the income from which will be used firstly for the annual award of a cash prize to authors of any nationality for the best paper of the year relating to the developments in basic steelmaking published by the Iron and Steel Institute, the parent body of the Newport and District Metallurgical Society, and secondly for the award of travelling scholarships to suitably qualified candidates under the age of 30 to study developments in steelmaking practice in another country. A total approaching £6,000 has been contributed so far and a sum of D.M. 50,000 (approximately £4,300) has been promised on behalf of the German steel industry.

Following the unveiling ceremony, Mr. Latham gave a succinct account of the achievements of this pioneer of the basic processes. Sidney Gilchrist Thomas, he said, was born in London in 1850, the son of William Thomas, a Welshman, and Millicent Thomas (*née* Gilchrist), a combination of the Welsh and Highland Celt. As a boy, he showed a strong desire towards applied science, but his father's death when he was only 17 prevented him from qualifying for a profession. He earned a living as a clerk in Thames Police Court, Stepney, in 1868 and remained there until 1879, *i.e.*, until his part-time experimental work at Blaenavon and elsewhere proved to be successful.

The young clerk began to study science privately and attended evening classes in much the same way as part-time students of today. During a course of lectures in metallurgy the comment that "the man who eliminates phosphorus by means of the Bessemer converter will make his fortune" fired his imagination and afterwards this problem became the ruling passion of his life.

At the age of 25, Thomas, from his training in chemistry, concluded that dephosphorization of molten iron would only be possible by lining the converter with a basic material such as lime, magnesia, or dolomite to withstand additions of lime which had a strong affinity for oxide of phosphorus. Thomas concentrated the whole of his energies on finding a suitable lining for the converter and communicated this "basic" theory to his cousin, Percy Gilchrist, who was appointed chemist at the Blaenavon Steelworks in 1876. At first, Gilchrist

was not very enthusiastic, but the persistence of Thomas prevailed and experimental tests suggested by Thomas were begun in 1877 with crucibles lined with limestone and lime, followed later with a small 6-lb. converter lined with limestone with sodium silicate as a binder. During this year Thomas arranged to be away occasionally from the police courts. So that he and Gilchrist could carry out tests each weekend, he often travelled to Blaenavon by the midnight train on Thursday night and returned on Sunday night.

Early in 1878 Mr. E. P. Martin, general manager of the Blaenavon Works, was admitted into the secret and he at once afforded facilities at the works on a larger scale, as well as at the Dowlais Works. A small fixed converter holding 3-4 cwt. of metal was erected at Blaenavon and some 50-60 " blows " were made. The next step was a series of tests in a 12-cwt. converter, and gradually the essential conditions for the removal of phosphorus from molten iron were determined. As a result, a paper was presented to the Iron and Steel Institute at the autumn meeting held in Paris in 1878 entitled " On the Elimination of Phosphorus in the Bessemer Converter ", but its importance was not realized and the paper was not read and discussed until the following May meeting.

At the Paris meeting, however, Mr. Windsor Richards, general manager of Bolckow, Vaughan & Company, Limited, Middlesbrough, met Thomas and was so impressed with the importance of the results that he and Dr. Stead, the consulting Metallurgist to his company, arranged to visit Blaenavon in October, 1878, to see some experimental " blows ", and as a result a series of large-scale tests was arranged to be carried out at the works in Middlesbrough in 30-cwt. converters early in 1879. Success was attained with a durable lining made from shrunk dolomite and tar and low-phosphorus steel was made by means of the " after blow."

An Industrial Reality

The manufacture of steel from phosphoric iron thus became an industrial reality and soon steel manufacturers from the Continent negotiated with Thomas for the patent rights for these countries. France, Germany, Austria, Belgium, and Luxembourg soon adopted the " Thomas " process as their available ores were particularly suitable. The basic open-hearth process was soon developed, as Thomas rightly regarded the use of basic linings as of general application and today the vast majority of steel in all countries is made by the basic process. Thomas recognized the importance of " basic slag " as a fertilizer and concentrated on its application in agriculture up to the time of his early death in 1885 before he was 35 years of age.

Pointing out that world production of basic steel today was in excess of 300,000,000 tons per annum, Mr. Latham said it was a sobering thought that with the high-capacity modern furnaces of today the chemistry of steel manufacture remained much the same as in the days of the invention of the basic process. Basic linings and lime additions in open-hearth furnaces up to 500 tons, basic-Bessemer or " Thomas " converters of 50 tons, and oxygen top-blown LD converters of 100 tons (which would be installed at the Spencer Works, Llanwern) were still essential features of these processes as in the small converters used by Thomas.

Thomas's reputation on the Continent was extremely high and was scarcely less so in the United States. A visit there in 1881 could only be described as a triumphant tour. He was received with open arms and entertained by the most important people in the American iron and steel world and, incidentally, negotiated the American process rights. Andrew Carnegie said of Thomas: " He had only to appear and we bowed before his power. I have never met a man who carried me so completely away as did Sidney Thomas and we felt that we had one of the great men of our generation as our guest."

The Blaenavon Site

In conclusion, Mr. Latham thanked Mr. R. Steel, of Daniel Doncaster & Sons, Limited, for having provided the site for the memorial and Mr. Newton Davis, of H. Davis & Sons (Sculptures), Limited, for the execution of the design and the erection of the memorial in collaboration with Mr. R. Payne, the architect. He announced that the head of Sidney Gilchrist Thomas had been modelled by the eminent sculptor, Mr. Fred Mancini, and cast at the Morris Singer Foundry in London.

Others who spoke at the ceremony were Mr. W. F. Cartwright, president of the Iron and Steel Institute, and Mr. R. Steel. Mr. Cartwright alluded to the recent modernization and future plans of the steel industry of this country and expressed the wish that something of the spirit of Sidney Gilchrist Thomas would be evident in the years to come. Mr. Steel said his company regarded it as an honour to have the memorial sited at its works. He invited all who were present to visit the two modern works now standing on the site, namely, the plant of Daniel Doncaster & Sons, which specializes in forging highly-alloyed steels and nickel-base alloys and the plant of Pickford, Holland & Company, Limited, for making magnesite and chrome-magnesite bricks.

Among the many others who were present were: Mr. W. Barr, a director of Colvilles, Limited, and a past president of the Iron and Steel Institute; Mr. K. Headlam-Morley, secretary of the Iron and Steel Institute; Mr. H. F. Spencer, managing director of Richard Thomas & Baldwins, Limited; Sir Andrew McCance, chairman of Colvilles, Limited; Sir Julian Pode, managing director of the Steel Company of Wales, Limited; Mr. R. T. Doncaster, managing director of Daniel Doncaster & Sons, Limited; Mr. J. Marcer, managing director of Pickford, Holland & Company, Limited; Mr. Arthur Thompson, chairman of Monmouthshire County Council; Mr. D. W. Puddle, chairman of Blaenavon Council, and Mr. T. G. Grey-Davies (hon. secretary), Mr. H. H. Stanley (chairman), Mr. T. Studley (hon. treasurer), and other officers of the Newport and District Metallurgical Society.

COAL-FACE DUST EXTRACTION

Developments in the United States

COAL-FACE dust collection in the United States has been considered of importance since the early 1930s and was first brought to prominent attention with the introduction of more powerful cutting machines compared with shortwall machines. In 1934, a number of machines with double-bar cutters cutting a 12-in. kerf were introduced for the removal of dirt bands in the coal. These machines immediately created a severe dust problem; a particular case was a two-bar machine used at the Warden mine of the Pittsburgh Coal Company, US, when attempting to cut out the Pittsburgh slate. It was found that a ventilation of 6,000 cu. ft./min. was required for adequate face dust removal and the dusty air was discharged into the return airways.

In 1937, water spray trucks, having a capacity of 250 to 400 gal., were installed on a large number of shortwall machines at the Pittsburgh Coal Company's mines, as well as mining operations of other companies. These sprays discharged approximately 10 gal. of water/min. at the outcoming portion of the cutter chain in an effort to reduce the dust count to 40,000,000 particles/cu. ft. The advent of continuous mining intensified research on methods for controlling dust.

The dust-collection problems in many operations with continuous miners is a formidable one. Dust counts run as high as 3×10^9 particles/cu. ft. and tests have indicated as much as 2 lb. of fine coal/min. being carried away by a ventilating current of 10,000 cu. ft./min. Most of the early efforts were related to the use of water sprays and water pressures of 50 to 100 lb./sq. in. were used. Although different methods were tried, such as the use of wetting agents, it was very difficult to control dust on continous miners with water at these pressures.

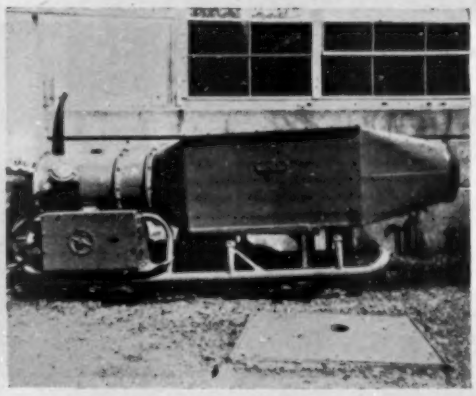


FIG. 1.—ANACONDA DUST COLLECTOR.

Numerous wetting agents were tried without noticeable results. A somewhat better method of controlling continuous mining dust was found in the use of high-pressure water. Water from 600 to 800 lb./sq. in. was introduced over the bar of the continuous miner by two sprays on each side of the machine—two spraying over the top of the cutter bar and moving with it, and two spraying over the top of the cutter bar from a more rearward position to pick up the dust created by discharge of the coal from the bar to the hopper.

Experiments with wetting agents in the high-pressure system were quite unsuccessful. In every test more dust was present when they were used. This appeared to be caused by dispersion characteristics of the wetting agent, possibly related to time, or to the nature of droplet formation in the spray. The high-pressure system was and is, if properly maintained, a relatively adequate means of dust control.

Reasons for Success

One of the reasons for the success of the high-pressure, four-nozzle system is that considerable energy at the sprays is being transferred into air circulation. This creates two large eddies horizontally which take the dust through the spray zone a number of times, thus increasing the opportunity for the mixing of water and dust particles.

In 1952, some experimental trials were carried out with a 6,000-cu. ft./min. American air filter, Type W Rotoclone, at one of the Jamison mines in Pennsylvania. This dust collector did a satisfactory job of collecting dust, but the problems of moving and levelling the relatively large unit required for this capacity could not be overcome. Sometime prior to 1955, a member of the Anaconda Company, US, demonstrated several dust collectors, using the flow-through impingement principle. Four steel plates with ¼-in. slotted openings each providing 35 per cent. open area were arranged in series, so that the dust travelled through a slot in one plate and impinged on an unslotted portion of the following plate. The plates were continuously sprayed with water and air passed through the slots at approximately 4,000 ft./min. This collector operated efficiently with a pressure drop of from 4 to 5 in. w.g. The patent rights on this collector (Fig. 1) were acquired about 1955 by the Joy Manufacturing Company, USA, and research work was undertaken to further improve the characteristics of the extractor. Fig. 2 shows the layout of the extractor. The newly designed collector was some-

what smaller than the previous unit, tested at an earlier date, but it was also considered to be too large.

New Device Developed

As a result of further research work on the unit, an entirely new device was developed at Joy's experimental station. A perforated screen, replacing the slotted plates, and continuously sprayed to produce a water film on the screen, was the basis of the new design. The dust-laden water leaving the stream is carried to a set of stationary turning vanes which spin the air and water back through a louvered water eliminator of the collector, where the dusty water is thrown out and enters the sump at the bottom. The spin energy in the air is recovered by a set of stationary recovery vanes at the downstream end of the water eliminator so that air moves axially to the fan.

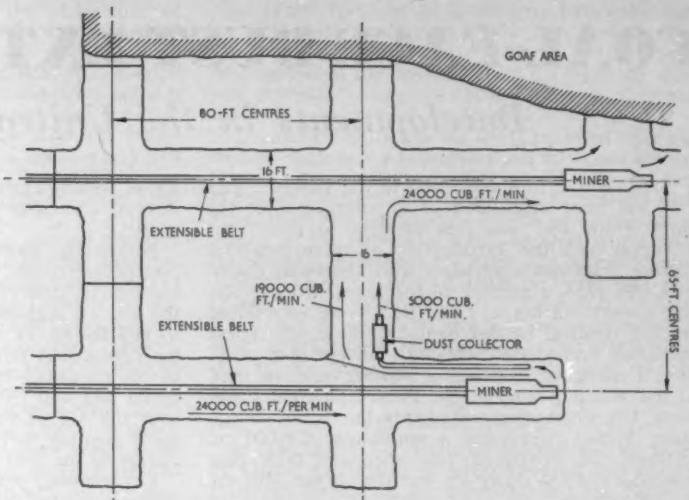


FIG. 2.—INSTALLATION OF DUST COLLECTOR IN PILLAR AND STALL WORKINGS.

The screen is made from stainless steel wire, with a diameter of about 0.010 in. The individual wires in the folds are arranged as shown in Fig. 3, which indicates that air as well as dust particles must turn when passing through the folded screen; thus, the dust particles are urged to impinge on the wetted wire. Dust particles at a velocity in excess of 4,000 ft./min. strike the wetted surface of the wire, penetrating the water film on the screen, and are retained by the water which leaves the screen as large droplets.

Using the principle of this dust collector, a special unit (Fig. 4) was designed for tests in mines. The machine was 12 ft. 6 in. long, 3 ft. 9 in. wide at its widest point, and 4 ft. high. At a water gauge of 11 in., 12,000 cu. ft./min. would pass and 8 gal. of water/min. was used in wetting the screen. The unit was powered by a 30-h.p. motor, and the air passed through a 24-in. duct. This machine was shortened in the water-collection section compared to the commercial unit so that only about 98 per cent. of the spray water was collected. It was felt that the remaining water discharge would be of no particular disadvantage, and the shorter size would be of considerable advantage.

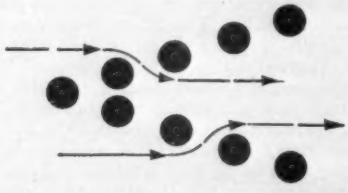


FIG. 3.—ARRANGEMENT OF WIRES IN STAINLESS STEEL SCREEN.

The collector was first tested in conjunction with a continuous miner at Joy's experimental station.

There were, however, still some significant problems facing the satisfactory operation of dust extractors. This unit, weighing from 3,000 to 4,000 lb., was still considered too heavy. The 24-in. duct, too, presented several problems; duct handling tended to be awkward as there was no easy method of coupling and uncoupling when extending or shortening; the duct took space which was needed in the working area.

Another problem was the supply of water and its disposal after use.

As a result of these problems a further attempt at a successful design has been made. The Joy Manufacturing Company's latest model is 19 in.

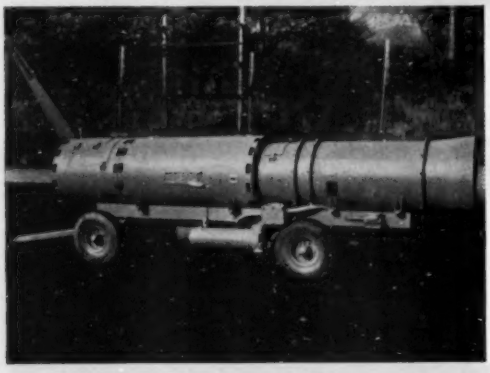


FIG. 4.—PORTABLE DUST EXTRACTOR FOR TESTS IN MINES.

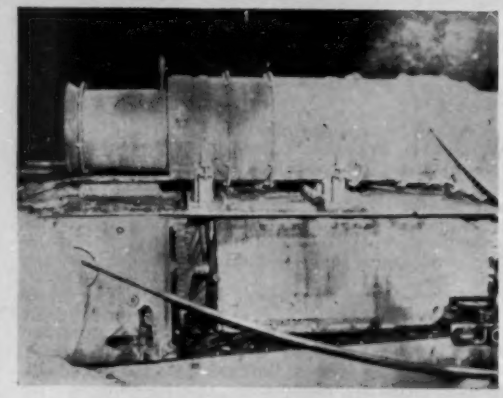


FIG. 5.—DUCTLESS EXTRACTOR MOUNTED ON A CONTINUOUS MINER.

dia., 54¼ in. long over the fan, and delivers from 5,000 to 7,500 cub. ft. of air/min. depending on duct length. The machine is powered by a 20-h.p. motor and requires 3 to 4 gal. of water/min.; its weight is about 550 lb.

Fig. 5 shows this collector mounted on a continuous miner. This particular application is one which appears to have considerable possibility where there is room to apply the collector. In this application, there is no duct used with the collector and 7,000 cu. ft./min. of air drawn from the face and discharged at high velocity to the rear of the loading machine. Brattice cloth is kept to within 75 to 100 ft. of the face and deflects the discharged air. This dust collector may also be mounted on the machine with ducting returning through a cross-cut to the return air, or it may be mounted in a cross-cut with the duct running to the machine. The mixed-flow fan provides high pressure and can provide adequate ventilation with smaller size duct.

Coal Mines (Compressed Air Blasting Shells) Regulations

COMING into operation on August 1, the Coal Mines (Compressed Air Blasting Shells) Regulations, 1960, made by the Minister of Power under the Mines and Quarries Act, 1954, apply to the use at coal mines of blasting devices which depend for their action on the sudden discharge of air from a chamber into which the air has been previously charged at a high pressure (the devices referred to in the regulations as "shells"). An inspector is given power to exempt any mine or part of a mine or anything at a mine from the application of any provision of the regulations, if he is satisfied that the safety of persons employed at the mine will not be prejudiced thereby.

Regulation 5 prohibits a person discharging a shell unless he has been appointed for the purpose by the manager of the mine and is, or is qualified to be appointed, a shotfirer at the mine.

Regulation 6 prohibits a person charging a hole with a shell unless the hole complies with certain requirements.

Regulation 7 requires that each shell shall be charged through a control valve to be operated only by a special, removable key. Regulation 8 requires that the person appointed to discharge the shell shall keep the key in his possession throughout the period during which he is on duty.

Regulation 9 requires that before a shell is discharged in certain mines or certain parts of mines tests for the presence of inflammable gas shall be carried out in accordance with the provisions of the regulation. Paragraph (3) prohibits a person discharging a shell if a test reveals more than a certain percentage of gas.

Regulation 10 regulates the use of shear discs, shear pins, and other similar things.

Regulation 11 requires that due warning shall be given to persons likely to be affected by a "blow through" caused by the discharge of a shell. Regulation 12 specifies the precautions to be taken by a person about to discharge a shell. Regulation 13 deals with the duties of sentries and persons in the vicinity.

Regulation 14 requires every person who has discharged a shell to ascertain whether, and ensure that, each working place affected by the discharge is safe for the resumption of normal working.

Regulation 15 requires certain precautions to be taken if a shell fails to discharge.

Regulation 16 prohibits the use of inflammable oil or grease for lubricating shells.

NCB and Coal Storage

STORAGE of coal as carried out by the National Coal Board is referred to by S. Weinberg and D. G. T. Davey in a paper presented to the Institute of Fuel and published in the Journal (June, 1960). Since the sudden reduction in the demand for coal about two years ago, storage space has become a problem.

The limit of coal depth to avoid spontaneous combustion had gradually been increased to some 15 ft., but since it was almost impossible to acquire new areas suitable for stocking, the depth of piles had to be increased until at present there are several stocks of considerable area 40 ft. deep.

Precautions necessary in siting these stockpiles include:— (1) The site should be completely cleared of vegetation, the surface being compacted and made flat; (2) the coal should be put down in layers of between 1 ft. and 2 ft. thick and fully compacted before the next layer is added, which should not be more than a few months later; (3) it is important to see that sides of the stock are compacted to prevent infiltration of air; (4) to avoid development of hot spots, freshly mined coal should not be added to fuel which has been a considerable time in storage.

New Literature

NEW catalogues, booklets, and other publications which have recently been received include those mentioned below. Readers interested in obtaining a copy of any of the publications referred to should apply direct to the address given, at the same time mentioning IRON AND COAL.

RANSOMES & RAPIER, LIMITED, Waterside Works, Ipswich—Publication No. 2/523 is an attractive brochure on RapieR high-discharge truck mixers.

EDGAR ALLEN & COMPANY, LIMITED, Imperial Steel Works, Sheffield 9—The July issue of Edgar Allen News contains much to interest the metallurgist.

INCANDESCENT HEAT COMPANY, LIMITED, Cornwall Road, Smethwick, Birmingham—Leaflet No. V60 is an attractive brochure dealing with "Jetube" vitreous enamelling.

HONEYWELL CONTROLS, LIMITED, Ruislip Road East, Greenford (Middx)—All one should know about the Honeywell ultra-vision flame detector is contained in a handsome brochure.

BRITISH TRANSPORT COMMISSION, 222, Marylebone Road, London, N.W.1—"British Transport in 1959" (price 2s.) is an interesting publication. Many of the photographs are in colour.

SOLUS-SCHALL, LIMITED, County Building, Honeypot Lane, Stanmore (Middx)—A number of interesting illustrated technical features are contained in the June issue of the company's News Letter.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND, 39, Elmbank Crescent, Glasgow, C.2—The Year Book and List of Members, 1960, is available to non-members of the institution at 7s. 6d.

EVANS & NEWALL, LIMITED, Moor Top Works, Heaton Moor, Stockport (Ches)—Three leaflets just issued deal with adjustable girder clips, concrete beam clamps, and the new "Fastclamp" adjustable girder clamp.

J. BROCKHOUSE & COMPANY, LIMITED, Victoria Works, Hill Top, West Bromwich—The torque converter as an aid to transmission performance is among the subjects of articles in the July-September issue of The Forge.

BRIGHTSIDE ENGINEERING HOLDINGS, LIMITED, Ecclesfield, near Sheffield—Technical and personal news of the Brightside group of companies and features general in character are presented in the summer issue of the Brightside News.

W. H. ALLEN SONS & COMPANY, LIMITED, Queens Engineering Works, Bedford—Included in the July issue of the Allen Engineering Review are articles on "Marine Alternators," and "Epicyclic Gears for Marine Propulsion."

NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY, 14, Welbeck Street, London, W.1—"Profit Sharing" and "Effects of Noise Reduction in a Work Situation" are among the varied contents of the April issue of Occupational Psychology, a quarterly magazine.

NATIONAL COAL BOARD, Chancery House, Chancery Lane, London. W.C.2—Month by month Coal Magazine is packed with articles and news of interest to all concerned with the mining industry. Robin Hill Drift Mine (Lancs) and Marley Hill Colliery (Co. Durham) are featured in the July issue.

SAMUEL OSBORN & COMPANY, LIMITED, Clyde Steel Works, P.O. Box No. 1, Sheffield 3—Personnel of the Osborn group of companies are very well served by Hand and Heart, their quarterly magazine, the summer number of which carries a large selection of news from the various works presented in attractive format.

BRADLEY & FOSTER, LIMITED, Darlaston (Staffs)—The main article in the summer number of Bradley's Magazine is a paper on "The Production of Diecast Ductile Iron Bolts for Flexible Pipe Joints," for which the author, Mr. R. H. Green, received a prize in the 1958-59 competition organized by the Staffordshire Iron and Steel Institute.

ATLAS COPCO (GREAT BRITAIN), LIMITED, Maylands Avenue, Hemel Hempstead (Herts)—Among the features of the latest issue of Compressed Air Comments is a description of the BR 13 air drill which is being used at the Pretoria plant of the South African Iron & Steel Industrial Corporation, Limited, to release molten iron from the blast furnaces.

APPLEBY-FRODINGHAM STEEL COMPANY, Scunthorpe (Lincs)—Appleby-Frodingham News is published "for the interest of all who belong to the company and their families." But its contents (mostly contributed by members of the company) are well varied and presented attractively and provide plenty to interest anyone into whose hands a copy happens to fall. The summer number is just out.

FOUNDRY SERVICES INTERNATIONAL, LIMITED, Long Acre, Nechells, Birmingham 7—Articles on "Hydrogen in Steel," "Degassing Copper Base Alloys," "The Effect of Degassing Treatment on the Sodium Content of Aluminium-silicon Alloys," and "The Refinement of Hyper-eutectic Aluminium-silicon Alloys" are included in the April issue of Foseco Foundry Developments.

STANTON IRONWORKS COMPANY, LIMITED, near Nottingham—"There has to be a drought before most of us appreciate the value of water." This sequence introduces an interesting article on the operations of the River Dove Water Board in the June issue of The Stantonian. The pages which follow are crammed with news of people and places, all presented in very readable style and attractively laid out.

SOUTH AFRICAN IRON & STEEL INDUSTRIAL CORPORATION, LIMITED, P.O. Box 450, Pretoria—Tar, a by-product of the coke ovens at Iscor's Vanderbijlpark and Pretoria Works, is now used as fuel in two of the five 200-ton capacity open-hearth furnaces at Vanderbijlpark. The conversion of these furnaces has brought about an increase in production from 27 tons to 40 tons per smelting hour, when using the scrap and hot-metal process with 60 per cent. hot metal. An article on the subject is among the contents of the May issue of Iscor News.

INDUSTRIAL ASSOCIATION OF WALES AND MONMOUTHSHIRE, Aberdare House, Mount Stuart Square, Cardiff—Industrial Wales, the quarterly published by the Association, presents an interesting picture of commercial activities in South Wales. Installation by British Railways of Britain's most up-to-date rail marshalling yard at Margam and the commissioning of the I.V. furnace plant for the commercial production of zinc and lead at the Swansea Vale works of the National Smelting Company, Limited, are among the subjects of articles in the June issue.

INDIA'S FOURTH STEEL PLANT

Plans to be Implemented

WHEN the all-party committee of MPs on the Third Five-year Plan discussed with Sardar Swaran Singh, Indian Minister of Steel, Mines, and Fuel, the implications of the proposed target of 10,000,000 ingot tons of steel, the main question was whether the proposed target would represent actual production or the capacity to be created during the Third Plan period. The Minister said that the achievement of actual production of 10,000,000 tons would depend on many factors about which one could not be very definite at this stage.

Some of the opposition leaders suggested that while additional plants would always be welcome, it would be wrong to keep the installed capacity of the existing units at a low level merely to accommodate a new unit.

The Minister told the committee that both the estimated requirements of steel and the overall resources position were being kept in view in fixing the target. The Bhilai steel plant would be expanded to produce 2,500,000 tons. For some years the demand for the particular categories of steel to be produced at Bhilai would be 2,000,000 to 2,100,000 tons. The rest of the capacity would be used for supplying pig-iron. The Rourkela plant, the Minister said, was expected to be expanded to 1,800,000 tons and the Durgapur plant to 1,600,000 tons.

The Minister added that, by and large, by the end of the Second Plan the capacity for the production of 6,000,000 tons of ingots to be rolled into 4,500,000 tons of finished steel and 750,000 tons of pig-iron for sale would be established.

A suggestion was made that the possibility of some State Governments establishing small plants might be explored, provided they could provide the necessary raw materials and technical personnel.

Need for Bokaro's Production

Despite the controversy which has surrounded the question of setting up a fourth steel plant in India at Bokaro during the concluding period of the Third Five-year Plan, the Ministry of Steel, Mines, and Fuel is initiating steps necessary to take in hand the plant's construction during 1964-65. The project report dealing with the plant's layout and other constructional aspects of the site is being implemented. Working out of the blueprint for the plant is likely to be initiated next year.

Steel experts of the Ministry are of the view that the country will once again be faced with considerable shortage of steel by the end of the Third Plan and beginning of the Fourth Plan, unless Bokaro starts producing by 1965. Their estimate of India's requirements of steel ingots during 1966 is put at 10,000,000 tons, which varies from the Planning Commission's conservative estimate of 8,500,000 tons. According to a survey of the Institute of Applied Economics, the estimated requirements of steel by the end of the Third Plan would be 9,500,000 tons.

The need to take up work on the Bokaro plant is stated to be all the more necessary in view of the availability of a large part of the machinery from the Ranchi heavy machine building project, which is expected to be available by 1964.

A long-range solution to the shortage of steel in Madras State is the establishment of a steel plant in the State by utilizing the resources it has, and the Madras Government is endeavouring to see that a steel plant is set up. Mr. R. Venkataraman, Industries Minister, Madras, said he was utterly disappointed at the actual quantities of iron and steel received in the State last year and subsequently. As against an indent of 7,700 tons, they had received in January and February only 375 tons. Thanks to the research done by Western countries, he said, particularly East Germany, it had now been found that ores of inferior quality could be used and that smelting could be done, not necessarily by metallurgical coal, but by high-temperature carbonized lignite.

He had taken up the matter with the Government of India and hoped that with the experience it had during the last few years and the shortage of steel, the Government of India would make due allowance for the establishment of re-rolling mills in Madras State

Smelting Ore with Lignite

Meanwhile, in New Delhi, Sarda Swaran Singh referred to the demand for the setting up of a steel plant in Salem, Madras State, and said it was the intention of the Government of India to utilize the iron ore in that area. "But the main hurdle," he said, "is the non-availability of coking coal." However, the technical feasibility of smelting the ore with lignite was being gone into, he added. A committee, including the representatives of Madras, had been appointed to go into the various problems. He said the Government had not so far received any offer of assistance from the United States for setting up a steel plant. "If and when interest is shown by the Americans, we will judge it on merits and take a decision in the national interests," he said.

Dealing with the criticism about the construction of the Rourkela steel plant with West German

help, the Minister said they had turned the corner as far as the two blast furnaces were concerned. Trial tests of these furnaces had yielded satisfactory results.

The project report on the setting up of a plant to smelt iron ore at Salem, utilizing lignite from Neiveli in the area, is expected to be submitted to the Madras Government in the immediate future. Experts of the firm of Demag A.G. have already visited Salem and Neiveli and found the iron content of the ore good for being smelted by the low-shaft furnace method. This firm has also been selected for undertaking the expansion programme of the Mysore Steel and Iron Works in Bhadravati. The programme envisages an increase in the output of steel by 100,000 tons and the plant is expected to go into production in 1962.

Pig-iron for UK

A consignment of 2,000 tons of high-manganese special basic pig-iron has left Calcutta for the United Kingdom. The consignment was shipped through Hindustan Steel's jetty at Bhadreswar, 20 miles from Calcutta. Hindustan Steel is making the shipments against orders for 12,000 metric tons of pig-iron valued at Rs.3,200,000. This will earn India foreign exchange worth £240,000.

The Board of Mineral Development in Mysore, a governmental organization, is negotiating an arrangement to work as a partner with the State Trading Corporation of India for the mining and marketing or iron ore in Mysore State. This is part of the board's programme for giving a fillip to iron-ore exploitation and to step up the export of iron ore from the State. The board has planned to double the export of iron ore to 2,000,000 tons during 1960-61, the bulk of it drawn from the rich Bellary iron-ore belt. Recently, the board itself took up the working of the two mines in the Bellary belt and has proposed to step the iron-ore production there to 200,000 tons a year.

Exports of iron ore from India were maintained at a fairly high level in the first quarter of this year; shipments from the major ports of Calcutta, Bombay, and Madras totalled 459,607 tons, valued at Rs.24,400,000, compared with 254,785 tons (Rs.13,000,000) in the corresponding period of last year. Japan was the most important buyer of Indian iron ore with an offtake of 264,586 tons in the first quarter of this year, followed by Czechoslovakia and Poland with offtakes of 68,796 and 66,650 tons, respectively. Other buyers were Germany (38,200 tons), Italy (20,100 tons), and France (275 tons).

The Japanese steel industry has started mapping concrete plans for the development of the Bailadila iron-ore mine in Madhya Pradesh, India, following the approval of the project by the Japanese Cabinet. The Japanese steel industry, which concluded an agreement with the Indian Government in March, is sending a group of consultants to India before July. Japan will invest about £7,500,000, mostly in the form of machinery required for the project. Japanese steelmakers are planning to negotiate the price of the Indian iron ore to be shipped from the mine to Japan so that it may be lower that the price at which Indian ore is exported to Europe.

A four-man Japanese steel industry mission has arrived in Goa to discuss a port improvement project to export iron ore to Japan. The Japanese group represents five major steel firms, which have contracted to import 3,000,000 tons of Goa iron ore in the next five years.

Book Review

A History of Labour in Sheffield. By Sidney Pollard. Liverpool University Press. 391 pp. 35s.

CONGRATULATIONS are due to the author on producing a most interesting factual study of Sheffield and its workers in the period 1850 to 1939. The book is in four main parts. The first forms a detailed background and introduction to the second part covering the years 1850 to 1893; parts three and four deal with the periods 1893 to 1914 and 1914 to 1939, respectively, and trace separately the fortunes of the heavy and light industries.

There is much of interest to the technologist as well as to the social worker and trade union official, and in these days of advanced mechanization and automation it is staggering to learn that years ago average file cutters, working under atrocious conditions for a meagre wage, struck 12,000 blows per hr. when using a 4-lb. hammer and 7,200 blows per hr. with a 7-lb. hammer. In 1869, before the introduction of modern bulk steelmaking techniques, we are told that the making of a 25-ton ingot required the contents of 672 crucibles to be poured into the mould at ¼ sec. intervals.

It has been a long haul from the steelmaking crucibles to the electric-arc furnace of over 100 tons capacity which will be commissioned in the area in the early 1960s.

Although tremendous technological progress has been made, we are reminded that, as human beings, we are not fundamentally different from previous generations. In 1850 or thereabouts "it was easier for manufacturers to pass on wage increases to their customers in the form of higher prices than to fight the unions. . . ." Again, in 1885 it was said that ". . . the prosperous operative is better off in comparison with the unprosperous middle-class man than ever before." How often do we imagine that price increases and redistribution of money are phenomena peculiar to the post-second world war era?

In a very minor key there are two technical points which appear to the reviewer to be in error. Annealing and tempering are specific operations involving different degrees of softening and this is not clear from the last sentence on page 51. On page 82 the carbon content of the steel produced from puddled iron seems extremely high.

THE NEXT International Compressed Air and Hydraulics Exhibition and Fluid Power Conference will be held at Olympia, London, from April 30 to May 4, 1962. Plans for a comprehensive international conference are being made.

"Our Changing Industry"

Presidential Address to Scottish Colliery Managers

By WILLIAM DUNCAN*

There is no need for despondency in the coal-mining industry and the thrill of achievement is greater than in any other industry. In his presidential address to the Scottish Branch of the National Association of Colliery Managers on May 4, 1960, Mr. William Duncan outlined the changes that are taking place in the consumption and production of coal. He suggested that in the years ahead the electrical generating industry will be the largest consumer of coal and, with generating stations properly sited, transport charges will be low and coal will be fully competitive with any other fuel at present known.

FROM the study of a 17th century map, the location of the Scottish coalfields shows little change from that of the present day, but when the trend of production since that time is examined (Table 1), a different picture is presented.

TABLE 1.—*Annual Production of Coal in the Scottish Coalfield.*

Year.	Output (million tons).
1700	0.475
1800	1.6
1900	37.0
1910	41.0
1920	31.5
1930	31.0
1940	30.0
1950	23.0
1960 (exp.)	18.0

The variation which has occurred over these years is closely linked with technical change in the use of coal. It is also associated with the extensive export coal trade which was carried on up to 1940 and was an important factor in the economy of the country. It is well to remember that coal was about the only product, natural or manufactured, Scotland had to export up to this time.

The growth of the coal industry has also followed closely the path of social change and it is impossible to separate this from the demand for higher standards of living. At the present time the morale of our industry is rather low, but there is no real reason for such an atmosphere. In years past, fuel in the form of coal has been the basis of our progress in the industrial world and fuel, in whatever form it may come, will be the governing factor in future prosperity.

Technical Change in the Use of Coal

The coal which we produce is converted into heat energy in one form or another and Table 2 shows how the coal was used and is expected to be used.

With scientific knowledge increasing rapidly, the trend of such usage may be considerably upset in either direction, or the demand for coal may be affected by many other factors such as:—(1) Events or discoveries; (2) the action of people in power in any part of the world; (3) humanity itself demanding a fair share of the fruits of the earth, particularly in the underdeveloped countries.

The mining industry has been constantly changing its pattern in the past, and there is no reason to believe it will not continue to do so in the future.

Change in Electrical Generation

In the years ahead the electrical generating industry will be the largest consumer of coal, and when we consider the improvements that have been made and will continue to be made in fuel efficiency the importance of this industry to the coal industry is clearly evident. In 1950, electrical generating plant consumed 33,000,000 tons of coal, when the thermal efficiency of the generating plants was only 19 per cent. In 1958, the quantity of coal used was 46,000,000 tons and the thermal efficiency had increased to 26 per cent.

The South of Scotland Electricity Board estimates that an improvement of 1 per cent. thermal efficiency means an annual saving of 110,000 tons of coal based on 1958 consumption. When Kincardine-on-Forth generating station is completed it is expected that the thermal efficiency will be 35 per cent.; in other parts of the world somewhat higher efficiencies are being obtained.

With generating stations properly cited and transport charges low, coal will be fully competitive

TABLE 2.—*Home Consumption of Coal in Great Britain.*

—	Consumption (million tons).		
	1950.	1956.	1965 expected.
Electricity	33.0	45.6	55.0
Coke ovens	22.6	29.3	35.0
Gasworks	26.2	27.8	21.5
Domestic	37.8	37.9	27.0
Industry	40.1	39.4	43.5
Railways	14.5	12.8	6.0
Collieries	10.7	7.9	8.0
Others	14.9	17.5	—
TOTAL	199.8	218.2	196.0

* Mechanization engineer, Area No. 4 (Central East), Scottish Divisional Coal Board.

with any other fuel at present known. With such rapid technical change in the use of fuel for the generation of electricity an efficient coal industry must surely form the basis of our national prosperity for many years ahead; nothing, so far devised can be more convenient to use and operate than electricity as a power or heating unit put into operation by the flick of a switch.

General Industry

In the next five years general industry is expected to use less coal, and while use of alternative fuels may to some extent be responsible for this, many are now depending solely on using electricity.

Coke Ovens.—So long as the steel industry is using coke to manufacture its products this demand will continue, but we must also expect that that industry will find more efficient ways of using our product and other ways of producing steel. The growing light alloy industry will yet be a fairly large power user in the reduction of the raw materials necessary for their manufacture. Electricity at low cost is the great essential for this purpose.

In the United States the largest aluminium producers find it more economical to bring the raw material to the heart of the coalfields where generation of electricity by coal cannot be equalled by any of the many fuels readily available in that country. It is a pleasant change to find one country where the demand for coal is increasing. In the American aluminium industry in 1958, only 15.6 per cent. of raw aluminium products was processed from coal. In 1960 the proportion is expected to be 37.9 per cent., and in 1975 the proportion will be 60 per cent.

Gasworks.—The progress of the Lurgi gasmaking plant at Westfield (Fife) will be followed with close interest by members of this association. Its success is paramount to our interests because we cannot separate ourselves from the industries which use our products and are part of our lives.

Railways.—For many years British Railways has been one of our best customers, using coal exclusively. Technical change in this industry has altered the pattern of transport, and machines made to use other types of fuel are proving more efficient. But we can take heart from the fact that the most prosperous and efficient railways in the world use electricity as their motive power.

In this country we are more favourably situated than any other for the electrification of our railways; there is no need for us to be dependent on foreign fuels for their efficient working.

A start has already been made on the 20,000-V system and the first experimental stretch between Helensburgh and Airdrie will be in operation this year. With the many other projects now planned, the electricity consumption on British Railways will be vastly increased in the years ahead.

As we should expect, the scientific and technical improvement in the use of fuel has saved many thousands of tons of coal for whatever process it has been used, but throughout this examination of the future use of coal, the adaptability of electricity to any industry is clearly evident. In future we must be closely allied to the electrical generating industry, not for the benefit of our industry alone, but for the wellbeing of our country as a whole.

In the recent paper of the OEEC Energy Advisory Committee it was interesting to note that the European consumption of fuel for industrial purposes is expected to be increased from 871,000,000 tons of coal equivalent in 1958 to 1,000,000,000 tons in 1965, and to 1,318,000,000 tons in 1975, with a possible increase in coal demand of 4 per cent. When one considers the expected intensive competition that will come from other fuels, this is a most encouraging thought for our industry. In the same report it is wisely said that now is the time to concentrate on making the coal industry healthy, rather than using it as an instrument of social policy.

A recent report of the Coal Mines Committee of the International Labour Office states: "World consumption of commercial energy has roughly doubled in the last 20 years and for each person has risen by 44 per cent. Between 1937 and 1957 hard-coal production increased from 1,264,000,000 metric tons to 1,728,000,000 tons."

Coal is black, but the future outlook for the industry is not the same colour. The whole pattern of life depends upon its efficient production and the need for competent colliery managers is now greater than ever before.

Technical Change in the Production of Coal

We need hardly look further than to the manner in which we have produced coal over the centuries to realize the changing nature of our industry. Many of the world's most important engineering developments have stemmed from the mining industry and, despite the amount of physical power used in the mining of coal, it can also be said that the total horsepower has also increased (Table 3). We have, nevertheless, not been slow to make use of every technical and scientific discovery.

TABLE 3.—*Ratio of Manpower to Horsepower.*

Year.	Manpower ('000).	Horsepower ('000).
1920	1,050	2,200
1930	870	1,800
1940	740	2,300
1950	700	3,100
1959	650	5,010

Investment of Capital.—In recent years the rate of change has been accelerated. Between 1954 and 1959, £610,000,000 was invested in the industry; in the next six years another £511,000,000 will be spent. Colliery management can look back with pride on the achievemnt in the use of this money.

The modern colliery is a triumph in engineering skill; it bears no resemblance to its trusty old predecessor. This is truly a monument to the

changing mining industry and a credit to all members who have played an important part in this great transformation.

In the transport of coal we are now using means which can be compared with any other country in the world and the industry's outlook on safety is unsurpassed by any other.

Mechanization.—Power loading of coal from the face is advancing as rapidly as machines can be made and devised for use in conditions that at all times are difficult. From 1950 to 1959, the percentage of power-loaded coal has risen from 3.8 of total output to 29.8 or in bulk tonnage from 8,330,000 tons to 72,500,000 tons in 1959.

Powered Supports.—In roof support use has been made of that most flexible medium—hydraulics. The use of powered supports is increasing at a rapid rate; in 1958, 31 faces were equipped: in 1959, 75 installations were completed, and in 1960, 160 faces are expected to be supported by hydraulics.

We are moving into the era where complete automation at the coal face is within our grasp. With fewer workmen at the coal face, the accident rate in the mines should be reduced, and workmen will have more confidence, resulting in improved productivity; this will surely be one of the greatest steps ever made towards safety in mines.

Conclusion

This is the golden jubilee year of the Scottish Branch of the National Association of Colliery Managers. In the life of this professional association many changes have taken place in the industry. These changes will continue in the years ahead, but never in all the history of coal mining can we read of a more interesting and exciting era than is with us at the present time.

There is no need for despondency in this basic British industry. The thrill of achievement is greater than in any other industry and the knowledge necessary to undertake the intricate technical application coal mining demands must be wide and extensive. The study of human nature and its application to human relations in industry grows more complicated in a world where social change moves more rapidly forward than technical change.

In 1911, the Home Secretary, Mr. (now Sir) Winston Churchill, introducing the Coal Mines Bill, said: "A large modern colliery, with its extensive and carefully elaborated equipment, including its various appliances for getting the coal, and bringing it to the surface of the ground, or transmitting power through long distances underground, and causing great volumes of air to flow through confined passages many miles in length, or draining wide areas underground and raising water to the surface, or sorting the coal into its various sizes, separating it from the intermingled dirt. That spectacle, as has been said, is one the most remarkable specimens of human activity in its struggle of human triumph over matter." That statement, made 50 years ago, is as relevant today as it was then.

Removing Hill of China Clay Sand

FOLLOWING the success achieved with a Euclid TS-24 on the contract with the Western Excavating Company, Limited, a further two machines have been ordered from Blackwood Hodge & Company, Limited, Northampton.

The job on which the three machines will be engaged is particularly interesting. It consists of the removal of a complete hill of china clay sand. The hill is approximately 200 ft. high and at its base covers an area of roughly 10 acres.

The units climb to the peak unassisted up a 1 in 3 gradient for a distance of approximately 300 yd., and then load down hill before travelling a distance of a mile to the dumping area.

The machine already operating is completing five trips per hr. over the 2-mile cycle.

Planning India's Coal Production

MEETING in New Delhi, the Coal Council of India accepted 95,000,000 tons as the Third Five-Year Plan's coal target and tentatively agreed to the field and gradewise allocation of the additional 35,000,000 tons production. There was, however, no decision or discussion on the crucial question of how much of the additional production should be in the public sector and how much by private collieries. Spokesmen of the coal industry are said to have urged that private collieries should be allowed to sink new pits in adjoining areas.

The Second Plan target of 60,000,000 tons of coal per annum is now expected to be achieved in 1961-62. The time-lag between the necessary ground preparation for raising that quantity and its actual production is not expected to be more than six months. Of the additional 35,000,000 tons of coal to be produced in the Third Plan, 9,500,000 tons will be coking coal and 5,000,000 tons semi-coking and blendable coal. According to the council's decision, the entire fresh production of coking coal will be allotted to the Jharia, Bhokharo, and Raniganj coalfields.

German Tests for Lignite

Although lignite does not fall within the scope of the council's consideration, there appears to have been a detailed discussion on the subject. It was felt that the contribution of brown coal as coking coal for steel production during the Third Plan would be considerable because of the superior quality of lignite in India as compared with what is mined in other countries. Hundreds of tons of lignite from Neiveli in South India are to be sent to East Germany for tests and the outlook for converting into coke is said to be very hopeful.

The council, comprising colliery owners and representatives of the National Coal Development Corporation, the Planning Commission, the Railway Board, and the Ministry of Steel, Mines, and Fuel, was called upon by the Minister of Steel, Mines, and Fuel, Sardar Swaran Singh, to organize the production of coal during the Third Plan period so that at no stage would it become a limiting factor in the industrial advancement of the country. Members of the council emphasized the need for planning sufficiently in advance to achieve the purpose. They also wanted expeditious setting up of the washeries to beneficiate coal for steel plants. According to assessments made on production, about 132 geologists and 2,070 drilling engineers would be required to man 150 drills that will be needed for the Third Five-Year Plan period.

Exports of coal from India last year totalled 1,427,638 tons, against 1,676,770 tons in 1958 and 1,763,983 tons in 1957. The decline, according to official sources, was due to the poor offtake by Pakistan, which lifted only 821,524 tons last year against 1,207,888 tons in 1958. Exports to Japan and Singapore were also lower—8,906 tons and 2,769 tons, respectively, against 19,134 tons and 4,415 tons in the previous year. Egypt and East Africa, which took 7,122 tons and 50 tons, respectively, in 1958, were out of the Indian coal market last year.

The fall in coal exports to these countries was, however, made good to some extent with larger offtakes by Burma and Ceylon, which lifted 366,653 tons and 212,000 tons during 1959, against 333,658 tons and 89,825 tons, respectively, in the previous year. Hongkong also took 59 tons and all other countries 15,727 tons last year.

East Pakistan will receive 75,000 tons and West Pakistan 40,000 tons of coal every month from India under the recent Indo-Pakistan trade agreement. East Pakistan is said to require about 90,000 tons of coal a month. This quantity does not, however, include the railways' requirements.

More Coal in Quetta

Prospects for large-scale coal-mining operations are growing as geological surveys are stepped up in the mountain area surrounding Quetta in Pakistan. This was reported by Mr. John A. Reinemund, of the US Geological Survey, which is co-operating with the Pakistan Geological Survey. Major explorations are being made in the Sor range of the Daghari coalfield, about eight miles from Quetta. Early indications are that these fields contain coal deposits sufficient to warrant large-scale operation, but additional surveys will have to be made to determine whether deep-mine operations will be economically feasible.

Mr. Reinemund explained that the deep-shaft operations are expensive because of the equipment required. He said that the coal from the Sor range was sub-bituminous, low in rank, but good in grade, which makes it adaptable for fuel use. Field operations in the Sor range, covering about 35 square miles of coal-bearing area, are under the direct control of Mr. Hussain, geologist of the Pakistan Geological Survey. Mr. Reinemund, who is a member of a team of six American geologists assigned to assist the Pakistan Geological Survey by the US International Co-operative Administration to Pakistan, described the Sor range as producing the best coal in Pakistan at the present time, but suggested that other areas in West Pakistan would probably yield more and better coal.

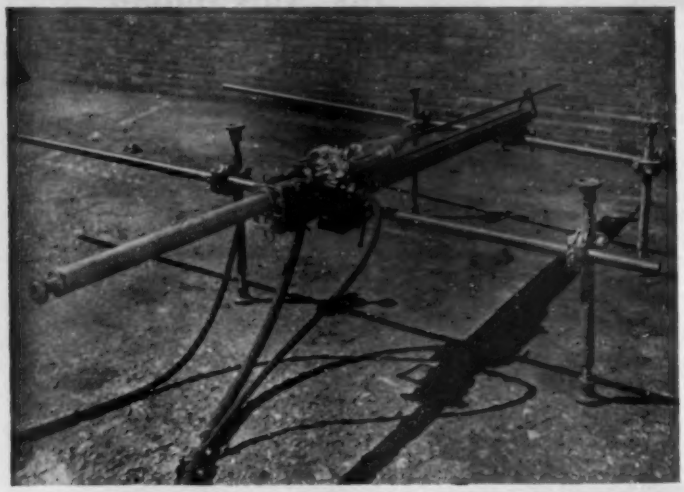
Finance for Formosa Steelworks

Support of the China International Foundation in the US will be forthcoming in connection with the construction of a steelworks in Formosa, according to Mr. C. C. Wei, a director of the Foundation. Negotiations with American firms and authorities were progressing favourably, he said. Of the $(US)50,000,000 required, about $2,000,000 to $3,000,000 would be obtained from Chinese shareholders. Initial capacity of the works would be 160,000 tons per annum. A $10,000,000 power station, to be erected near Kaohsiung by the Tan Eng Iron Works and the Taiwan Aluminium Corporation, will supply the steelworks with electricity.

"Thruster" Drill Rig for

Long-hole Stope Drilling

DEVELOPMENT in South Africa of a revolutionary new drilling unit, the Holman Thruster rig, for use as a long-hole stope drilling machine is announced by Holman Bros. (Proprietary), Limited, Johannesburg, the South African subsidiary company of Holman Bros., Limited, Camborne (Cornwall). The new Thruster rig has been developed to meet the increasing need in African mines for an accurate, compact, and easily portable long-hole driller for use in limited space and headroom, particularly in flat and narrow stopes.



HOLMAN THRUSTER DRILL RIG WITH THE ROCK DRILL IN THE EXTREME OUTWARD POSITION ON THE SLIDE RAIL AND THE CYLINDER PROTRUDING THROUGH THE SLIDE GATE COLLAR READY TO BEGIN THE FIRST-STAGE FEED OF THE DRILL.

This drilling rig was evolved from an early experimental model which comprised a rock drill, powered by a feed cradle, supported on a lightweight tubular steel frame which could be adjusted in height by means of screw-end jack bars.

Difficulties were experienced due to the weight of this unit which prevented its easy movement underground.

After further research into this problem a completely new feed system for this type of drilling application was discovered and the Holman Thruster was successfully developed.

The new feed system comprises a cylinder and piston assembly, similar to the retractable air leg, which provides the necessary feed to the drill. The cylinder is horizontally mounted directly behind the drill on a slide rail, and the feed pressure is controlled by a twist-grip throttle. The slide rail assembly is supported on two tubular steel cross members which are in turn supported on four adjustable screw-end jack bars.

The piston rod is fitted with two air passages, one to provide air behind the piston for forward movement and the other for its retraction. A valve controls the simultaneous change-over of air to the front or rear of the piston. The cylinder body is also designed to move forward and backwards in a slide during the advance feed and drill extraction operations.

When the cylinder is in the extreme outward position away from the rock face and the piston is fully withdrawn inside the cylinder, air is admitted behind the piston, which pushes the piston rod towards the face and provides the first-stage feed for the drill. When the piston is fully extended the control valve is operated, which admits air in front of the piston. The piston with drill attached remains stationary because of the weight of the drill and the frictional resistance of the drill steel in the rock.

The cylinder mounted in the collar slide is, therefore, drawn towards the face. When the cylinder has moved up to the end of the piston rod, a gravity-operated slide gate mounted to the cylinder slide operates, which locates in an annular groove on the outward end of the cylinder body. This prevents the cylinder moving when air is again applied behind the piston, which starts the second stage of feed to the drill.

To withdraw the drill the sequence is reversed. Air is first admitted in front of the piston which causes the piston rod, with drill attached to move into the cylinder. When fully retracted the slide gate is lifted so that the cylinder is free to move outward in the cylinder slide and air is switched to behind the piston. At the end of its stroke the cylinder is locked in position by a second sliding bar which prevents further movement of the cylinder. Air is reapplied in front of the piston, causing the piston rod and drill to retract fully.

DSIR's Increased Research Grants

LAST year, the Department of Scientific and Industrial Research increased the number of grants to universities and technical colleges for researches in every field of science except mathematics. In the field of metallurgical research a breakthrough of great significance has recently been made, using electron-transmission microscopy. This has been achieved by workers at Cambridge University.

It is now possible to follow by cine-techniques the arrangement and motion of dislocations when a metal foil is strained to breaking point. Microstructures virtually down to the atomic scale can be seen for the first time. It can also be observed, for instance, what happens when a pure metal is suddenly cooled from a high temperature, and how nuclear radiation damages the crystal structure. This new technique of transmitting through a thin metal foil offers a great opportunity to understand thoroughly how the engineering properties of solids result from atomic structure and properties.

Workers in this field include Dr. P. B. Hirsch, of the Cavendish Laboratory, whose researches are supported by a DSIR grant of £18,730, and Prof. A. H. Cottrell, of the Department of Metallurgy, Cambridge, who was awarded a grant of £15,000 for electron microscopical study of metallurgical problems.

Steel Research at Sheffield

A research grant of particular local significance has been awarded to Sheffield University for work on transformations in steels. The grant, worth £36,000, enables Prof. A. G. Quarrell and his colleagues in the Department of Metallurgy to purchase new apparatus, offering greatly improved techniques in the study of the structure, composition, and properties, both microscopic and macroscopic, of steels. The research programme includes a study of the fracture surfaces of various cast steels, a more precise determination of the role of alloying elements, the effect of cooling rate, and the influence of "trace elements." Structural changes during the working of iron-manganese-carbon alloys, creep properties, the constitution of slags and slag-metal reactions and a host of other research problems of significance to the steel industry are also being undertaken.

Seaborne geophysical work off the north-east coast of England in extension of land surveys in Durham and Northumberland has been facilitated by a grant of £1,500 made to Durham University. The survey includes an attempt to find out more about the eastern margin of the coalfield.

The DSIR's annual report for 1959 (Cmnd. 1049, Stationery Office, 4s. 6d.) says that over 360 applications for research grants, totalling over £3,300,000, were received during the year, compared with 204 applications, amounting to £1,350,000, in 1958. Of these, which include nuclear physics and human sciences, 295 (163 in 1958) were awarded, totalling £2,232,000 (£1,090,000). These grants, for the purchase of equipment and employment of assistants, and other aid, are normally spread over a period of two to four years. This strengthening of DSIR support to universities and technical colleges on a broad front is the first stage in the fulfilment of the department's second five-year plan. In step with this progress is the expansion in the number of awards for post-graduate training. Research studentships rose by a fifth to 928 (777 in 1958), making a total of 2,144 studentships (new and continuing), compared with 1,681 in the previous year. Over 250 advanced course studentships were awarded during the year, compared with 184 in 1958.

IFC Aids Indian Refractories Expansion

INVESTMENT by the International Finance Corporation of $1,365,000 in Assam Sillimanite, Limited, an Indian company, for expansion of operations to manufacture high-grade refractory bricks and shapes is announced. Incorporated in 1951, Assam Sillimanite has been engaged in mining and processing for export sillimanite, magnesite, and kyanite —minerals used in high-temperture furnaces employed by the steel, glass, and ceramics industries. The company works valuable deposits of some of these minerals in India.

The IFC investment will help finance a plant designed to produce 46,000 tons annually of refractory materials. India imported more than 120,000 tons of refractories in 1957. Production by the new plant will fill some of the basic needs of India's growing industries for high-temperature furnace materials. All raw materials are available locally. It is estimated that the first two years of full operation will provide net annual foreign exchange savings to India equal to IFC's dollar investment. The new plant is estimated to cost $3,255,000.

Luxembourg Steelworks to Increase Production

STEEL production at the Differdange works, Luxembourg, in 1959 totalled 1,093,190 tons and exceeded the previous year's output by 25.7 per cent. There were particularly large increases as regards strip (39 per cent. increase) and merchant bars. Production of welded tubes was 55,036 tons.

The works' expansion programme was completed to schedule, the fourth sinter furnace, two soaking pits, two boilers, and the new marshalling yard being commissioned during the year. Further projects will include the construction of a new sinter plant and installation of new reheating furnaces in the blooming, bar, and strip mills.

Ore output at the Differdange, Ottange, and Rumelange mines totalled 2,599,249 tons, a reduction of 5.2 per cent. compared with the previous year.

THE ECSC LEVY for the year from July 1 has again been fixed by the High Authority at 0.35 per cent. of total production value.

THE COAL TRADE

WHILE the domestic trade is slack everywhere, it seems to be the concensus of opinion that trade is a little better than a year ago and the outlook not quite so gloomy. The break in the good weather may give a much-needed fillip to this section of merchants' business. There is still a fairly active demand for graded anthracite and customers are having the satisfaction of fairly prompt delivery in the quantities ordered. Coke still remains a problem and much more business could be done.

SCOTLAND

Glasgow—As usual just before the Glasgow Fair, holiday trade in most sections has dwindled to a low level. The principal exception is coking coal, with suppliers hard pressed to provide sufficient quantities to tide the coke ovens over the two weeks and ensure enough to allow capacity throughputs when the steelworks resume operations. Coking coal usage is double last year's rate, but supplies are adequate. Supplementary tonnages are being lifted by the coal board from the large stock which accumulated last year. The surplus is still substantial, but if the present scale of lifting is maintained there is a possibility that it will be almost eliminated by the end of the year.

Other industrial sorts are plentiful, including singles. Pearls are almost a drug on the market and large tonnages are going down at pithead. Gas-making doubles and trebles are being taken up steadily, and electricity smalls clear well, but surplus duff is available. Consumption of house coal fell recently to 38,000 tons a week, contrasting with 47,000 tons a year ago and the 1960 high of 95,000 tons in February. The nadir of 20,000 tons last summer occurred at the end of July. Merchants' stocks, however, are increasing and at 169,000 tons are 22,000 tons up on last year.

A heavy backlog of orders ensures an immediate offtake of anthracite stove nuts, but beans are in excess supply. Anthracite duff is slower to sell and a surplus of anthracite large is going on the ground. Hard coke nuts, gas coke, briquettes, and manufactured fuels are subdued. Metallurgical and foundry coke requirements are heavy, but supplies are adequate.

Fife and Lothians—With the holidays continuing in the Lothians business is all being done by Fife. A steady trade is passing in house coal to the remote northern districts of the country, where stockpiling is always undertaken early. Exports are quiet.

YORKSHIRE UNDERGROUND TUNNELLING PROJECT

ONE of the biggest tunnelling operations in the Yorkshire coalfield this century is being carried out 900 ft. underground between Dewsbury and Wakefield. More than 40 men are driving through solid rock to provide a 3¼-mile-long tunnel to link Shaw Cross and Thornhill collieries.

Work is expected to be completed by the end of July and a spokesman for the North-Eastern Divisional Coal Board said last Friday that it would mark the end of a seven-year operation. Coal from Thornhill will be taken by locomotive through the tunnel to be wound at Shaw Cross, having already come 1¼ miles by tunnel to the Combs shaft where it is now being wound. Total cost of the project is estimated at £300,000.

European Talks on New Industries for Coalfields

BRITAIN will be represented at a five-day meeting to be held in Luxembourg starting on September 26 to discuss the question of introducing new industries to areas affected by changes in the coal industry. Also present will be representatives of the six member countries of the European Coal and Steel Community, spokesmen for the European Common Market and the European Investment Bank, and members of the International Labour Organization.

Points to be worked out at the conference include the industrialization of the ECSC coalfields with industries other than coal mining. On July 22, the High Authority is to meet in Luxembourg to discuss the possible drawing of a dollar loan for this purpose.

Hard coal production of the six member countries of ECSC in the first half of the current year was 118,170,000 metric tons, 53,000 tons lower than that for the corresponding period of 1959. Output in west Germany and the Saar rose by 0.5 per cent. over last year's total, while 3.3 per cent. more was produced in Italy and 2.8 per cent. more in Holland. Production fell over the period by 0.1 per cent. in Belgium and 1.9 per cent. in France.

At the end of March, the Authority states, a total of 461,000 workers and staff were employed in the coal mines of the Ruhr, Aachen and Lower Saxony, in west Germany. This is down by over 81,000 compared with the beginning of 1958.

At a meeting of the IG Bergbau German mineworkers' union in Dortmund last week it was urged that the retirement age for mineworkers should be lowered from 60 to 55 for face-workers and from 65 to 60 for surface workers.

NUM Decides Fate of Winding Enginemen

IN secret session at Llandudno on Thursday of last week, the National Union of Mineworkers' conference approved by 642 votes to 38 a proposal to transfer members of the Yorkshire Winding Enginemen's Association to branches of the NUM. A similar proposal was carried affecting members of the Derbyshire and Nottinghamshire Winding Enginemen's Associations. The NUM executive is to fix a final date by which the proposals must be carried out, but hopes that local agreement will not make compulsion necessary.

Officials of the two associations have resisted the proposal but the NUM is confident that the members will accept the reorganization.

Coalfield News

Two Candidates for Yorkshire NUM Presidency

ORIGINAL list of 11 candidates for the presidency of the Yorkshire Area of the National Union of Mineworkers has now been reduced to two—Mr. Sam Bullough, vice-president of the Area, and Mr. Jock Kane, NUM branch secretary at Armthorpe Colliery. The final ballot is not expected to take place until the week beginning August 29.

Mr. Bullough, who has been acting-president of the Area since the death of Mr. Alwyn Machen, has the backing of West Yorkshire and several South Yorkshire branches. Mr. Kane spent three years on the staff of the National Coal Board as labour officer for the Doncaster Area. He resigned to return to pit work. The Yorkshire presidency carries with it a seat on the national executive of the NUM.

IN RECOGNITION of 20 years' service as chairman of the Llanhilleth Lodge of the NUM and a lodge membership of 40 years, a presentation has been made to Mr. R. G. Rice.

PENSION SCHEME for underofficials who retired before nationalization is to be inaugurated by the National Association of Colliery Overmen, Deputies, and Shotfirers. Benefits will be 10s. 6d. a week.

MINERS' LODGES in South Wales are being invited to nominate a candidate to succeed Mr. Aneurin Bevan as MP for Ebbw Vale. The miners' nominee will go forward to the divisional Labour Party selection committee and take his chance with other candidates.

BLACKSMITH'S STRIKER at North Gawber Colliery, Barnsley (Yorks), Mr. Arthur Rowe is also British, Empire, and European shot-putt champion. He has just returned from Moscow where he took part in a Russian athletic meeting and defeated his Russian opponent with a 60 ft. 3 in.-throw.

EXCEPT for a short period at Barnsley Main Colliery, (Yorks), Mr. Ernest Hall has spent all his working life at Darfield Main Colliery, where for the past 25 years he has been a deputy. On his retirement last Friday he received a presentation from the colliery branch of the National Association of Colliery Overmen, Deputies, and Shotfirers.

WEST FIFE MINE RESCUE TEAM was called out to Fordell Colliery when a haze of gas was reported to be spreading through the Lochgelly splint section of the pit, following an outbreak of spontaneous combustion in old workings. The fire was sealed off and a NCB spokesman said that there was no danger and production had not been affected.

IT IS UNDERSTOOD that because of a patch of heavily faulted ground the National Coal Board has been compelled to revise its preliminary plans for the working of the new pit at Bevercotes, near Retford (Notts). A Coal Board official said the difficulty was a commonplace one and would in no way affect the main development of the pit.

STRIKERS at Wharncliffe Woodmoor Colliery (1, 2, and 3 units) returned to work on Monday. The pit, which employs 1,200, had been idle since Thursday because of the retaliatory action by day-wage men who said they were tired of losing their bonuses through strikes by higher-paid contract workers.

CUT OF ABOUT 50 to 60 per cent. of the labour force is to be made at Morrison "Busty" Colliery (Co. Durham) next month. Some surface workers at the pit will become redundant when the new skip-winding gear is installed during the annual holiday to replace the existing cage and tubs. A union official said that of those men who were not transferring to other pits in the area some were nearing retirement age and others would be absorbed by other industries.

TOTAL COAL AND COKE SHIPMENTS from the South Wales ports during last week were 52,180 tons, which is the second best figure for over three months. It was 5,013 tons better than the previous week and 7,796 tons more than the corresponding period of 1959. Tonnages from the various ports (with 1959 tonnages in parentheses) are as follow:—Newport, 5,116 (4,990); Cardiff, 4,747 (9,304); Penarth, 1,590 (3,838); Barry, 4,373 (9,966); Port Talbot, 2,349 (3,292); Swansea, 34,005 (12,994).

A DOUBLE TICKET for a weekend trip to Blackpool for the illuminations with expenses paid is a prize that 51 safety conscious workmen, employed by the Durham Divisional Coal Board, can win over the next few weeks. Prize draws to decide the winners are being held in various parts of the coalfield. In addition to the 51 main prizes are 510 consolation awards of £1 premium bonds. The scheme is being held to stimulate interest in the board's successful Greater Safety Campaign.

Coal Stocks Have Saved Thousands of Jobs

"THE National Coal Board and the Ministry of Power have been violently criticized for not having a bargain sale of stocks, but these stocks have saved thousands of men from being dismissed," said Mr. John C. George, Parliamentary Secretary to the Ministry of Power, when he spoke at Alloway, near Ayr, last Saturday. He said the stocks represented the labour of 50,000 men for one year, and tied up £130,000,000 which the Coal Board could profitably use in other ways, but this was the price of preventing widespread misery and pain in the coalfields.

Mr. George said the end of the slump in the coal industry had been reached, and a slight upward tendency in sales was evident. This year the board expected to sell all the coal produced, and perhaps 2,000,000 to 3,000,000 tons from stock. For Scotland, even more than for the rest of Britain, it looked as if the period of cutting back production was largely past, and little more reduction in manpower would be needed. If coal were to defeat oil, however, the efficiency of the industry was of first importance.

Output per manshift in Scotland was the worst in the country, he said, and Scots coal was costing more than £5 a ton to produce—the most expensive in Britain. Last year probably 17s. per ton was lost on every ton produced there, and something much better was needed if Scotland was to maintain its position. The big new pits gave the industry a chance of proving itself against the challenge of oil.

"With good management and full co-operation, Scotland can become a prosperous coalfield. If Scotland fails to measure up to the challenge, the industry can wither and decline."

APPLICATION by South Durham Steel & Iron Company, Limited, to construct a £1,000,000 plant for preparing slag for use as a fertiliser, has been rejected by the Town Planning Committee of West Hartlepool Corporation because noise and dust from the plant might cause a nuisance to nearby residents.

Rail Wagon Shortage and Firebrick Delays

SHORTAGE of special railway wagons required for transporting firebricks had resulted in delivery delays and many steel customers were demanding deliveries by road, Mr. J. M. Cooper, works manager of United Fireclay Products, Limited, Armadale (Lothian), told the Scottish Licensing Authority at Edinburgh on Monday. He was supporting an application by Russell of Bathgate, Limited, road transport contractors, to add 12 articulated vehicles to a licence to carry United Fireclay's products to steel customers in South Wales, Sheffield, and North-east England.

Mr. Cooper said the firm had started a new kiln which would produce 400 tons of firebricks a week on top of the normal production of 600 tons. About 70 per cent. of the traffic was rail-borne, but special wagons were required for pallets and they had been in short supply. Requests were made to the railways in June for up to 25 wagons a day, but only four or five were provided.

Objecting to the application, Mr. J. Fleming, transport manager of British Railways' Scottish East Coast Division, said he did not agree the brick company had ever ordered 25 wagons, their usual request being for about 10. There was normally a surplus of wagons in the pool. Many stockyards, including those of the Steel Company of Wales, Limited, were laid out for rail wagons and the railway facilities were adequate to deal with the increase.

The Licensing Inspector, Mr. W. Quin, said he regarded the need for additional vehicles as proved, but decision would be reserved as to the exact number until he had examined the evidence in detail.

"Misleading" Attacks on Machine-tool Industry

THOUGH the threat of nationalization of the machine-tool industry has receded, attacks on the industry continue, says Mr. J. B. S. Gabriel, chairman of Charles Churchill & Company, Limited, manufacturers and agents for machine tools and engineers' supplies, of Birmingham, in his annual report to shareholders. These attacks were "largely fed by the much publicized but somewhat misleading report of Professor Melman," says Mr. Gabriel.

"Some of his comments, which are not new, call for serious consideration. To implement his basic idea, apparently conceived during a short visit to the USSR and to the Continent, and without a single visit to a major member of our industry, Government direction would be required to decide on the types and sizes of machine tools to be built, which companies should be amalgamated, and to instruct customers what machines they would have to buy, regardless of their views on the subject. We believe that this would be most damaging to every user of machine tools, and seriously jeopardize export prospects," he warns.

Mr. Gabriel, also states that any uncertainty in industry which existed earlier in the year has gone and there has been a dramatic upsurge of new orders for machine tools, resulting in a healthy order-book being created again.

These orders were received too late to have a material effect on the profits of the group during the period under review.

Belgian Coal Industry Reorganization

SITUATION of the coal industry in Belgium remained the most worrying of all the member countries of the European Coal and Steel Community, M. Roger Reynaud, a member of the High Authority of the ECSC, told the community's consultative committee recently. In spite of the real efforts of reorganization and re-adjustment carried out, and the protective measures taken, he said, serious disequilibrium persisted and brought in its train more unemployment than had been foreseen.

Belgium's Minister of Trade, M. van der Schueren, in a recent speech in Strasbourg, asked the European Parliament to make an appreciation of the difficulties facing the industry in its efforts to reorganize. He stressed his Government's willingness to carry out the two closure programme suggested by the High Authority and excused the failure of his Government to present its second reorganization plan to the executive on May 1, by stating that it was not possible at present to judge what course the development of individual pits would take.

Last year, he said, a cut totalling 2,270,000 tons of capacity had been made and in the current year it was intended to cut the national output by some 2,700,000 tons. Over and above the cut in capacity required by the first reorganization programme, it was hoped to close an additional 1,000,000 tons of annual production during the year, the Minister said.

Despite these assurances, the members of the ECSC are perturbed by the Belgian coal production figure for the first half of the year, which—according to current statistics—is likely to be some 11,600,000 tons. This is an increase of 400,000 tons on the previous six months and 100,000 tons more than output in the corresponding period of last year.

In a debate at the European Parliament last week, the Belgian delegate, M. Bertrand, expressed the opinion that the whole of the Borinage coalfield in his country should be closed. Mr. Dirk Spierenburg, a member of the High Authority, stressed that a solution to the whole ECSC problem could be effected within the Common Market area power structure. Decisions must be reached, he said, on the introduction of a common trading policy in the power field. This called for the co-operation of the national governments and not simply their protestations of willingness. The problems of the increasing coal stocks within the community, the delegates concluded, could not be solved by the independent action of national governments.

The Federal German Government has offered to take over the 5,000 Italian mineworkers at present working in Belgium in an effort to help reorganization. Difficulties have arisen, however, since apart from the reluctance of the Italians to be transferred, Belgium wants to send the miners' families with them. As insufficient living accommodation is available in the Aachen coalfield where the miners are needed, a decision is dependent on the provision of housing estates by the German authorities.

RETURNING from the British Scientific Manufacturers' exhibition in Russia, Mr. H. E. C. Nash, manager of the computer division of Elliott Bros. (London), Limited, announced that the National-Elliott 803 computer which was shown at the exhibition had been bought by the Russian Institute for Automation Research.

Board Changes

BARROW HAEMATITE STEEL COMPANY, LIMITED—Mr. J. K. Howarth, secretary and a director, has been appointed assistant managing director. He will continue as secretary.

METAL INDUSTRIES, LIMITED—For many years a director of Lancashire Dynamo Holdings, Limited, which became part of the Metal Industries group earlier this year, Mr. F. H. Schroeder, has been appointed to the board.

HALL ENGINEERING (HOLDINGS), LIMITED—Mr. Cyril H. Griffin, and Mr. John H. Russell have joined the board. They are managing directors, respectively, of British Reinforced Concrete Engineering Company, Limited, and Hall & Pickles, Limited, subsidiary companies.

TRIPLEX SAFETY GLASS COMPANY, LIMITED—Mr. Barrie Heath, formerly managing director of the Powell Duffryn Carbon Products Company, Limited, has been appointed managing director in succession to Sir Graham Cunningham, who has retired from the post but will continue as chairman.

HARRISON (BIRMINGHAM), LIMITED—Mr. W. H. Demel, managing director, has retired from the board due to ill health. Mr. John M. James and Mr. Philip Green have been appointed joint managing directors, and Mr. K. E. How and Mr. A. M. Brookes have joined the board. As from January 1, 1961, the company will become the holding company of two new wholly-owned subsidiaries—Harrison (Birmingham) Brassfoundry, Limited, which will concentrate on the brassfounding side of the business, and Harrison (Birmingham) Metals, Limited, metal rollers and extruders. In addition to the directors of the parent board (other than Mr. How) the board of Harrison (Birmingham) Brassfoundry will consist of Mr. A. L. Sayer, Mr. T. Bowyer Jackson, Mr. B. G. Dewsbury, Mr. T. Riley, and Mr. R. V. Woodward, and that of Harrison (Birmingham) Metals of Mr. L. E. Disturnal, Mr. G. P. V. Jones, and Mr. Riley.

Pit Manager Died From Heat In Disused Working

MANAGER of Thurcroft Main Colliery (Yorks), Mr. Sidney Parker (49), who was found dead in disused workings in the pit, died from exhaustion due to heat, humidity, and lack of oxygen, a Rotherham inquest was told last week. The jury returned a verdict of Accidental Death.

A deputy, Mr. Ernest Hodkin, said the manager left him to go to a disused part of the mine. The ventilation in that part was sluggish, and attempts had been made in the previous fortnight to reventilate the area, he said. Some hours later after a search, Mr. Parker was found lying on his back.

Dr. Gilbert Forbes, pathologist, said Mr. Parker had minor scratches on his body, indicating he had stripped to crawl through narrow passages, or had been stumbling about in his exhaustion. There was a dry bulb temperature of 100 degrees and a wet bulb temperature of 94 at the place where Mr. Parker was found. Any person exerting himself where the temperature was 94 degrees would be very likely to die from exhaustion or heat stroke, or a combination of both.

Mr. Parker was a member of the National Association of Colliery Managers.

Brighter Prospects for Coal Exports

HOLIDAYS are having their effect on the output of saleable coal, especially in the Durham, North-Western, and South-Western divisions, and production so far this year is over 7,000,000 tons down on a year ago. The coal export trade is considerably brighter than at the corresponding period last year. Exports in the 26 weeks ended July 2 totalled 2,570,000 tons compared with 1,548,000 tons during last year.

There were 598,700 wage-earners on colliery books on July 2, against 660,000 on July 4, 1959, the numbers engaged at the coal face being 228,500 and 256,900 respectively. Total absenteeism (all workers) in the week ended July 2 was 14.53 per cent. compared with 14.41 per cent. in the week ended July 4, 1959. Output at the face was 3.954 tons and overall 1.383 in the week ended July 2, compared with 3.744 and 1.345 tons in the week ended July 4.

The following table gives (in tons) the output of saleable mined coal by division in the week ended July 9, and the tonnage lost through all causes (holidays, disputes, and go-slows):—

Division.	Week ended July 9, 1960.		Week ended July 11, 1959.
	Total output.	Tonnage lost.	Total output.
Scottish	290,000	74,300	316,000
Northern (N & C) ..	185,600	63,400	180,900
Durham	371,500	110,000	370,500
North-Eastern ..	756,200	94,500	791,900
North-Western ..	122,100	146,000	140,000
East Midlands ..	871,900	34,700	876,500
West Midlands ..	279,900	—	321,900
South-Western ..	284,500	117,300	276,800
South-Eastern ..	31,400	500	34,500
Great Britain—			
Deep-mined coal..	3,193,100	640,700	3,309,000
Other deep-mined (including licensed mines) ..	37,700	—	46,900
Open-cast coal ..	157,200	—	233,200
TOTAL	3,388,000	640,700	3,589,100

Liquidation of Fife Coal Company to be Closed

STOCKHOLDERS of the Fife Coal Company, Limited, in voluntary liquidation, have received a letter notifying them of a general meeting to be held in Glasgow on August 1, at which the liquidator will submit a statement. The letter explains that the liquidation has been kept open pending the outcome of the appeal to the House of Lords in the case of the Commissioners of Inland Revenue v. Whitworth Park Coal Company, Limited.

Last November, the Lords decided in effect that tax should not have been deducted from interest paid on compensation monies. The liquidator thereafter intimated a claim to the Ministry of Power for repayment of interest paid by the company. The Finance Bill of 1960, however, contains provisions which will regularize the deductions, and will in effect nullify any benefit which the company might otherwise have obtained from the Lords' decision.

On the assumption that the provisions of the Bill will duly become law, he now proposes to close the liquidation.

NEWS IN BRIEF

SOME 750 EXHIBITORS, 120 of them from outside the host country of West Germany, will be present at the International Machine Tool Exhibition to be held in Hanover from September 11 to 20.

STEEL PRODUCTION IN THE US this week is estimated by the American Iron and Steel Institute at 1,513,000 tons, compared with 1,203,000 tons last week and 1,097,000 tons in the corresponding week of 1959.

DUTCH STEEL CONCERN, Koninklijke Nederlandsche Hoogovens en Staalfabrieken, of Ijmuiden, has reduced its official list price for pig-iron by Fl.50 per metric ton. The new price now varies between Fl.250 and Fl.285 per metric ton ex works.

A STEELWORKS is to be built on the Black Sea coast in Turkey by Koppers Company, Incorporated, of Pittsburgh, USA. It will cost some $185,000,000, of which $41,000,000, for building and labour costs, will be met by the Turkish Government.

SHEFFIELD is soon to have a cutlery trades bibliography of world-wide scope. Cllr. J. Thorpe, chairman of the libraries committee, said that it would include every book on the subject in the English language with a very large number of references to periodicals.

CRUDE STEEL CAPACITY of Hüttenwerke Oberhausen, the German steel concern, is to be increased to 2,500,000 tons annually within a year. The company has just put a 200-ton open-hearth furnace into operation and a similar furnace is shortly to be built and should be producing within a year.

THE International Nickel Company of Canada, Limited, has paid $265,000 for a group of about 60 claims which could lead to the opening of a new area for base metals in Manitoba. The claims are close to Island Lake, about 200 miles south-east of Inco's mine near Thompson, Manitoba.

FOUNDATION STONE of a steelworks in Tarento, Italy, was laid on Friday last. The plant will help to raise Italian steel production to some 10,100,000 metric tons in 1965, assuming the use of 90 per cent. capacity. Of this total, plants owned by the State holding company, Finsider, will produce 6,500,000 tons annually and other plants 3,600,000 tons.

THE MINISTER OF POWER, Mr. Richard Wood, is to be asked by the parish council to abandon the opencast mining site of almost 100 acres at Polesworth (Warwickshire). Work on the extraction of an estimated 690,000 tons of coal began last year, but was abandoned at the end of the year and is not expected to begin again until early in 1961.

DISCUSSIONS are in progress between Dorman Long & Company, Limited, and G. A. Willis, Limited, paint manufacturers, of Middlesbrough, regarding a new method of coating some steel products (but not structural steel) for their protection. The two companies are considering the erection of a factory to handle manufacture, but no site has yet been negotiated.

PYGHTLE (BEDS) WORKS of John P. White & Sons, Limited, has been acquired by W. H. Allen Sons & Company, Limited, mechanical, hydraulic, and electrical engineers, also of Bedford. The property covers 3¼ acres and adjoins the main works of W. H. Allen. The company intends to transfer the manufacture of electrical control gear from its Biddenham works.

DEVELOPING QUANTITIES of new materials for use in the making of semi-conductor devices for the electronics and electrical industries are available from Monsanto Chemicals, Limited, it is announced. They are monocrystalline and polycrystalline gallium arsenide, polycrystalline indium arsenide and polycrystalline indium phosphide. All are made by Monsanto Chemicals, of the US, which controls the UK company.

IN RECOGNITION of his "public spirited action" a presentation was made last week to Mr. Maurice Quinton (19), a vertical miller, on behalf of the directors of H. G. Smith (Steel Fabrications), Limited, manufacturers of sheet metal pressings and welded fabrications, of Willenhall (Staffs), by Mr. J. G. Round, the chairman. Mr. Quinton's prompt action recently averted what could have been a serious fire in the company's offices.

WITH THE OPENING of a new branch office at Swansea on Monday F·AG Bearing Company, Limited, will have 10 branch offices operating in Britain and serving all the major centres of industry. The Swansea branch at 36 Mansel Street (telephone: Swansea 53304), is to be managed by Mr. B. J. Reynolds. The recently opened branch at 35 Call Lane, Leeds 1 (telephone: Leeds 35955-6) is under the management of Mr. E. Parkin.

INSTRUMENTATION and automatic-control equipment made by George Kent, Limited, Luton (Beds), was demonstrated by the firm's mobile exhibition in Moscow recently at a six-day exhibition arranged in connection with the First International Congress of the International Federation of Automatic Control. The event was organized by the USSR National Committee of Automatic Control together with member organizations of IFAC.

A HOUSE OF COMMONS' MOTION tabled by 152 Labour MPs notes with grave concern "the much publicized proposals to alter the basic structure of the publicly-owned coal-mining industry, and calls upon the Government to repudiate proposals to decentralize control and statutory authority in the coal-mining industry, which would result in divisional boards operating as separate entities with statutory powers in respect of trade and accounting."

SPECIAL CONCRETE CHAMBER, with walls between 2 ft. and 3½ ft. thick, has been built in the new welding shop at the Darlington works of Whessoe, Limited, designers and builders of capital plant for the oil, atomic power, gas, and chemical industries. It is to house a Cobalt 60 isotope which will be used for gamma-ray welded steel plates. The installation of the unit is one of the main features of the modernization programme at the Darlington works, which to date has cost about £1,500,000.

THIS AUTUMN, the Royal Society for the Prevention of Accidents is to hold a one-week residential safety training course for safety officers concerned with accident prevention in the building and civil engineering industries. The course will cover both theoretical and practical aspects of the work. All enquiries should be made to the Training Officer, Royal Society for the Prevention of Accidents, Industrial Safety Division, Artillery Mansions, 75 Victoria Street, London, S.W.1 (telephone: ABBey 6963/7).

FOLLOWING the announcement of the offer of Cambridge Instrument Company, Limited, for the whole of the ordinary share capital of Electronic Instruments, Limited, it is proposed that Electronic Instruments will operate under its own name. Mr. A. C. W. Norman will continue as chairman with Mr. P.

Goudime as managing director and Mr. D. A. Pitman as sales director. They will be joined by three directors of Cambridge Instrument and Mr. Goudime will join the Cambridge Instrument board.

EQUIPMENT AND machinery will be displayed by at least 240 leading companies at the factory equipment exhibition sponsored by the Manchester Chamber of Commerce and other interests, to be held at Belle Vue, Manchester, from September 21 to October 1. The exhibition is supported by more than 250 trade and technical associations, institutions and societies. Exhibits will be grouped in 21 separate sections, each corresponding to a major division of industry. Area of the exhibition already exceeds 150,000 sq. ft., and there is a waiting list for each section.

WORKING conditions at the Abbey Works of the Steel Company of Wales, Limited, Port Talbot, returned to normal on Monday when the 340 stocktakers, dispatchers, and recorders called off their 24-hour strike and went back to work. The strike brought the hot strip mill to a standstill for 14 hours. The dispute began after the men, seeking improved bonus payments for weekend and holiday working, had enforced an embargo on overtime. When the management refused to withdraw temporary holiday relief workers while the embargo was in operation, the men walked out.

EXHIBITION OF SCIENTIFIC equipment covering almost the whole range of industrial research and laboratory control and development for British industry was opened on Tuesday by Mr. K. G. Sinclair, chairman of Griffin & George, Limited. About 30,000 educational and industrial scientific instruments made by Griffin & George and by 20 other manufacturers whose equipment is distributed by the group were included in the three-day exhibition at Birkbeck College, University of London. Among the special fields covered were chromatography, microscopy, and soil mechanics.

Normal Working at Arrael Griffin Colliery

NORMAL working was resumed last Friday by the 14,000 men employed at the Arrael Griffin Colliery, Six Bells, Abertillery, the scene of the explosion on June 28. A mass meeting of the men heard from NUM officials that an inspection of the pit had been carried out and that conditions were again satisfactory.

At a meeting of the South Wales Area of the NUM on Saturday delegates deplored a statement made by Mr. Ness Edwards, Labour MP for Caerphilly, in the House of Commons. After the meeting Mr. W. Whitehead, Area president, said there was not a shred of evidence to support the implication made by Mr. Edwards that the accident could have been caused by gas percolating from neighbouring Marine Colliery. Such a statement was unfortunate in that it only served to heighten tension and emotion at a difficult time.

Families of the men killed in the accident will have received £14,533 from the National Coal Board, Mr. E. A. Lewis, secretary of the South-Western Divisional Coal Board, stated at a meeting of the Six Bells Colliery Disaster Fund Committee on Monday. The board had already paid out under the Mineworkers' Special Fatal Accidents Scheme £200 to each widow and children's benefits ranging from £33 to £133. Total benefits paid out by July 5 amounted to £9,433. In addition to this each widow has this week received a lump sum payment of £150.

Up to Wednesday evening contributions to the fund totalled £32,383.

Orders Placed

Indian Order for English Electric

FOLLOWING the recent announcement of the Indian Government's intention to concentrate on heavy industry during the Third Five Year Plan, comes the news that the English Electric Company, Limited, has secured an order in connection with a new aluminium plant. The Hindustan Aluminium Corporation has ordered rectifiers and transformers, valued at about £500,000, to supply direct current power for aluminium smelting at its plant in Uttar Pradesh State.

The plant is near the Rihand power station, which will supply most of the electricity used for smelting. The equipment is to be shipped to India in the spring of 1961.

TWO CONTRACTS have been signed by Stewarts and Lloyds, Limited, for the supply of steel tubes to the Russian Government. The first, valued at £135,000, is for 1,500 metric tons of seamless steel tubes and the second, valued at £324,000, is for 3,250 metric tons of hot finished tubes.

ORDER for Morrsflex-Hammond automatic metal polishing machinery, worth £10,000, was booked by B. O. Morris, Limited, at the International Machine Tool Exhibition, Olympia. The machinery is made under licence from Hammond Machinery Builders, Kalamazoo, Michigan, USA.

COMPLETE FINISHING LINE PLANT for a 9 ft. 4 in. heavy and medium plate mill at the plant of Forges de Clabecq, SA, Belgium, is to be supplied by Schloemann, AG, Düsseldorf. The equipment includes a hot leveller, rotary trimming shear, rocking shears, roller tables, a cooling bed with plate turner, manipulators, pilers, and scrap handling gear.

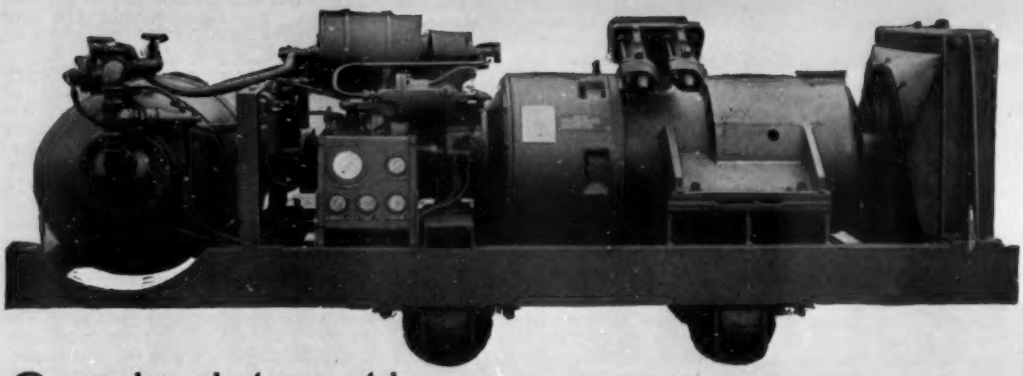
LARGE ORDER for "Fin-Fan" air cooled heat exchangers has been placed with Head Wrightson Processes, Limited, a subsidiary of Head, Wrightson & Company, Limited, by the Iraq Petroleum Company, Limited. They will be used to cool lubricating oil from gas turbines at two pumping stations. The total installation is worth approximately £55,000.

Two 11kV 15 mW single pass-out turbo-generators have been ordered from the General Electric Company, Limited, by the Government of Qatar, in the Persian Gulf, for installation in a new power station to be built at Ras Abu Aboud. The order is worth £700,000. The first generator set is to be delivered by December, 1961, and the second by March, 1962.

PRIESTMAN BROS., LIMITED, Hull, has ordered an EMI-Wadkin electronically controlled drilling machine, worth nearly £10,000, from EMI Electronics, Limited. It will be used for making drill jigs and for other toolroom uses. It can accurately position and drill holes up to 2 in. in diameter in thick steel in a fraction of the time taken by a skilled operator working a conventional drill.

FOLLOWING the recent announcement that the Ford Motor Company, Limited, has placed a £500,000 order with Toledo Woodhead (Springs), Limited, Sheffield, comes the news that three other British companies have secured contracts in connection with the production of Falcon cars. Clifford Covering, Limited, Birmingham, is to supply steering wheels, Pollard Bearings, Limited, Knottingley (Yorks), is to supply clutch release bearings, and Ward & Goldstone, Limited, Salford, is to supply the wiring. The initial value of all the orders placed is approximately $1,000,000.

COMPRESSED AIR UNDERGROUND



Growing interest in Rotary Machines

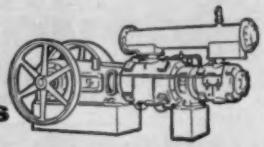
There is steady growth in the number of "Power Vane" rotary compressors in service underground.

Undoubtedly, the low temperature operation of the "Power Vane" is of particular interest to the mining engineer, as the discharge temperature is some 100°F lower than any equivalent reciprocating compressor. They can be air or water cooled to suit service conditions.

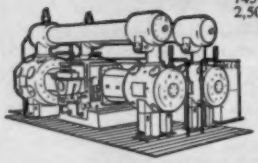
The simplicity of the rotary principle not only results in a substantial reduction in upkeep costs but at the same time permits the design of extremely compact units. This is illustrated in the above photograph of a special low-height mine-car "Power Vane" rotary compressor built for service in South Africa.

Full details of the standard air and water cooled Rotary stationary compressors are available on request.

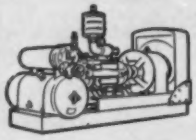
THESE ARE THE FOUR BASIC TYPES



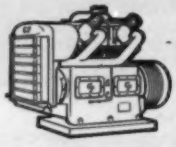
Class T straight-line, double-acting, single and multi-stage compressors for outputs up to 745 c.f.m. or pressures up to 2,500 p.s.i.



Class FE balanced-opposed multi-cylinder compressors for outputs up to 8,000 c.f.m. or pressures up to 3,000 p.s.i.



Class RE electrically driven Rotary Air Compressors for outputs up to 510 c.f.m. at 100 p.s.i.



Class P two-stage air-cooled compressors for outputs up to 477 c.f.m. at 100 p.s.i.

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Hour Cut in Pit Week May Cost £15,000,000

MINERS are to have their working week shortened by one hour under an award of the coal industry's National Reference Tribunal. The change is not to be introduced at once, because the National Coal Board and the National Union of Mineworkers will have to work out how the reduction is to be made. The tribunal has stated, however, that the shorter week must be introduced on a date between five and seven months from July 8, 1960. It is believed that the concession will cost the board at least another £15,000,000 a year.

The union had claimed a seven-hour shift for underground workers in place of the present shift of seven and a half hours, and a 40-hour week for surface workers in place of the present 42½ hours. They also wanted all meal times to be included in the 40 hours; about half the surface workers have a 42½-hour week which excludes meal times. The tribunal specifically rejected the demand for the inclusion of meal times.

The men at present work a five-day week. Shifts on the surface are 8½ hours each. Underground the shift lasts 7½ hours, but included in this is one "winding time"—the time taken for a man to travel between the pithead and his place of work. The other winding time is taken from the man's own time. The average length of one winding time is less than half-an-hour.

The tribunal has rejected a claim for an additional 2s. 8d. for men employed in the Coal Board's coke and by-products plants who regularly work on a two- or three-shift system.

The tribunal, which is headed by Lord Morris, is still considering the union's claim for another 12s. a week for 300,000 miners on time rates.

"Modern Mining" Exhibition for Yorkshire Boys

"BIRD'S eye view of the coal mining industry" was what an exhibition at Schofield Technical College, Mexborough (Yorks), aimed to give school-leavers, said Mr. R. G. Baker, deputy chairman of the North-Eastern Divisional Coal Board, when he opened it on Tuesday. At least 1,200 boys from more than 20 schools in the area will see the exhibition, which is being run by the college's mining advisory board in conjunction with the NCB. It depicts the rapid mechanization programmes now taking place in the pits.

On this subject Mr. Baker said: "There is almost an engineering paradise for people who come into this industry at this stage." Mechanization of the pits was nothing to what it would be. "You will see machines in the quite near future undreamed of at this moment or purely on the drawing board."

At a conference of head teachers and NCB officials, after the opening, one of the speakers said that the worst advocates of mining, when it came to a career for their sons, were miners. In his experience when miners' sons were asked why they wanted alternative careers, it was invariably the father who replied: "I work down the pit and he is not going down." It was suggested that the board should tell the miners about mining—about the opportunities for their sons in the modernized industry.

Record Level of Investment by ECSC

INVESTMENT in the coal and steel industries of the member countries of the European Coal and Steel Community in the first four months of this year reached the record level of $733,000,000. Investment in the steel industry was $627,000,000 and in the coal industry $106,000,000. The figure for the first four months compares with $670,000,000 for the whole of 1959.

M. Roger Reynaud, a member of the ECSC High Authority, described the number and amount of declared investment projects as "spectacular." Reviewing the economic situation in the Community countries, he told the Community's consultative committee last week, that while industrial production in the first quarter of the year had been more than 14 per cent. up on the same period in 1959, the pace of growth was expected to slow down, as in certain industries and countries the limits of productive capacity appeared to have been reached.

Industrial production in the third quarter of the year was nevertheless expected to be some 8-10 per cent. higher than in the same period a year ago. The steel market continued to enjoy favourable conditions. The high level of economic activity in the Community was maintaining internal demand, and export orders had tended to rise again in the last few months.

The Authority has stated that it expects satisfactory conditions in iron and steel markets to continue in the third quarter of this year. Orders on hand stood at the normal level of three delivery months. Sufficient scrap on hand and the increased proportion of pig-iron used in steel production would ensure an adequate supply of scrap without heavy imports.

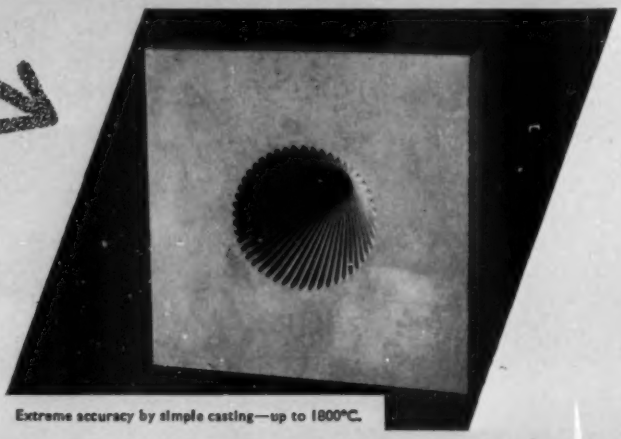
A slight fall in production in the third quarter was expected, however, following the high production levels of the first two quarterly periods of 18,200,000 and 18,000,000 metric tons respectively. An output of some 18,100,000 tons of steel was expected for the period, against a Community consumption of some 18,500,000 tons. About 8,550,000 tons of the production total would come from West Germany. Pig-iron output is estimated at 13,800,000 metric tons, and pig-iron imports at 150,000 tons. An increase in pig-iron consumption in ECSC steelworks to 710 kg. per metric ton was expected.

Mr. Nabarro's Advice to NCB

CHANGES that must be made in the structure of the National Coal Board would not include a return to district wage agreements, said Mr. Gerald Nabarro, Conservative MP, on Tuesday. Mr. Nabarro, who is vice-chairman of the Conservative Parliamentary Power Committee, was addressing the summer conference of the Federation of Co-operative Fuel Managers' Associations at Loughborough (Leics).

Much better improved administration and better marketing of coal were essential to avoid greater financial losses, he declared, and added that it would be the duty of Mr. Alfred Robens, when he became chairman of the NCB, to carry out changes to this effect in conjunction with the Minister of Power.

The present NCB set-up was not "a sacred cow" and if decentralization were thought advisable, it was the duty of Parliament to help. The Conservative Party, he emphasized, would oppose demands for nationalization of retail coal distribution.



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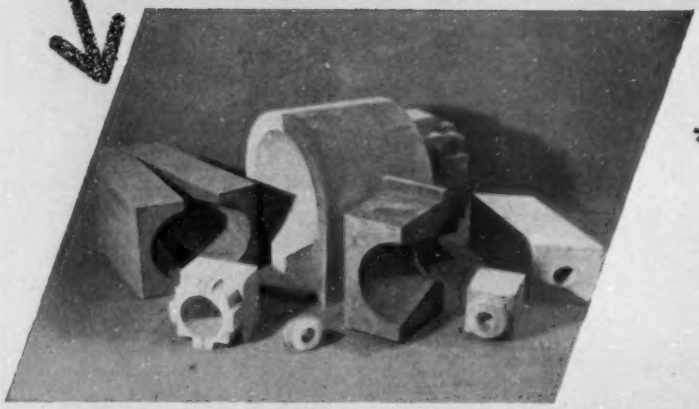

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AP77

Obituary

The death occurred suddenly on Friday last of Mr. BENJAMIN R. HOLGATE, former director of W. & S. Summerscales, Limited, domestic machinists, of Keighley (Yorks). He was 67.

The death has occurred of Mr. JOHN FITZPATRICK, director and secretary of Fitzpatrick Springs, Limited, West Bromwich (Staffs). He joined the company 35 years ago, becoming secretary 15 years later, and a director in 1951. He was 50.

Well-known figure in Fife mining circles, Mr. WALTER YOUNG, has died. He spent 57 years as a mining engineer until his retirement last year. For 25 years Mr. Young was chief mining engineer at Michael Colliery, and he had held a number of other appointments in the Area.

Mr. DAVID MATTHEWS has died at the age of 66. In 1955 he retired after nearly 30 years' service as supervisor of the blacksmiths' workshop of the NCB central works at Cowdenbeath. He initiated the manufacture of many items of colliery equipment, including mine cars, cages, and conveyor pans.

The death has occurred of Mr. JOHN H. BIRCHALL, personnel manager of Guest, Keen & Nettlefolds (South Wales), Limited. He was 54. Mr. Birchall joined the company at Rogerstone 24 years ago and after a period at the Warrington works, transferred to Cardiff when the new works were opened.

The death occurred suddenly on Monday of Mr. THOMAS WILFRED SMITH, stock control officer of the No. 9 (Neath) Area, South-Western Divisional Coal Board. He was 54. He began his career in the coal-mining industry as a boy with the Tareni Colliery Company, Limited, Pontardawe, becoming secretary to the managing director.

The death occurred on Tuesday of Mr. SIDNEY BRAMHALL, chairman and managing director of Smith's Stamping Works (Coventry), Limited, at the age of 68. He joined a subsidiary of Smith's Stamping Works —Smith Clayton Forge, Limited—in 1934 and became a director of both companies two years later. In 1954 he became chairman of Smith's Stamping Works (Coventry). He was also a director of Mitchell, Shackleton & Company, Limited, and its subsidiary, Clarke's Crank & Forge Company, Limited.

Banksman's Lapse of Memory Killed Mineworker

WHEN a jury on Monday returned a verdict of Accidental Death on a Warsop mineworker, Mr. A. C. G. Rothera, the Nottingham City Coroner, said: "The is the sort of accident in the mining industry which ought not to have happened." The inquest was on Thomas James Stubbs (62), who was crushed between an empty mine car and the upper structure of the shaft side. He had gone to collect a tea can from a cage on the shaft to make tea for men below ground.

Mr. Walter Mitchell, a banksman, said he was working the ram "blind." It must have been a lapse of memory on his part that the accident happened. He knew Mr. Stubbs was going for the tea can.

The coroner said: "One has a great deal of sympathy for Mr. Mitchell, who realizes that he operated the ram when he had momentarily forgotten he had not had the all-clear from Mr. Stubbs."

Coal Stocks Position

DETAILS of coal stocks as at July 2, 1960, compared with those available at July 4, 1959, are given in the appended table issued by the Ministry of Power.

Figures in parentheses, mainly calculated on the basis of requirements during the winter, indicate the total weeks which the tonnage in stock would last.

Week ended:—	July 2, 1960.	July 4, 1959.
	Thous. tons.	Thous. tons.
Distributed stocks—		
Public-utility undertakings—		
Gas	2,065 (4.0)	2,544 (4.7)
Electricity	5,709 (4.9)	6,659 (5.9)
Railways	477 (2.3)	562 (2.6)
Coke ovens	1,700 (3.3)	1,519 (3.1)
Industrial consumers—*		
Iron and steel	197 (1.7)	203 (1.8)
Engineering and other metal industries	260 (2.9)	320 (3.6)
Other industries	1,791 (3.1)	1,896 (3.3)
TOTAL INDUSTRIES	2,248	2,419
Merchants' stocks—		
(*a*) House coal	992	1,074
(*b*) Anthracite and boiler fuel	175	155
Miscellaneous (estimated)	265	362
TOTAL DISTRIBUTED STOCKS	13,631	15,294
Undistributed stocks—		
At collieries (on ground and in wagons)	28,265	22,201
At open-cast sites	6,516	6,522
TOTAL UNDISTRIBUTED STOCKS	34,781	28,723

* Excluding stocks held by the smaller consumers of less than 1,000 tons per annum.

Pit Relief Board Chairman Since 1916 Re-elected

FIRST elected chairman of the board of management of the Midland District Miners' Fatal Accident Relief Society in 1916, a position he has held ever since, Sir Robert Martin was once more re-elected at the 309th quarterly meeting of the board in Derby last Saturday. Sir Robert paid tribute to the South Wales Miners' Association, and members stood in sympathy for those who lost their lives in the recent accident at Six Bells Colliery.

The report on the operations of the society during the quarter stated that membership had risen by 380 to 76,548, and the total number of beneficiaries was 1,657—an increase of five. Contributions totalled £8,159, an increase of £110, and annuities paid to widows and orphans increased by £139 to £9,109. Balance to the credit of the Benefit fund was £3,214.

THIRD BRITISH exhibition to be held in Moscow in recent months was opened by Sir Patrick Reilly, the British Ambassador, on Monday. The exhibition—of yarn processing and knitting machinery—is a joint venture between the Bentley Engineering Group, Limited, Leicester, and Scragg Textile Machines, Limited, Macclesfield (Ches).